(Ir)responsible Takeovers*

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Abstract

We model how socially conscious acquirers and target shareholders respond to externalities in corporate takeovers—and whether such considerations enhance or undermine market efficiency. Our analysis revolves around two free-rider problems: the "holdout" problem of Grossman and Hart, and free-riding in externality production. We give a sharp characterization of equilibrium outcomes. Despite the two free-riding problems, externalities are fully internalized if target shareholders have consequentialist preferences and the acquirer is purely profit-motivated. More generally, we identify a balanced-preferences condition under which externalities are fully internalized; and show that socially undesirable acquisitions occur if the condition fails. We apply our analysis to the impact of trade between socially conscious and purely financial shareholders; the role of exchange offers and leverage in acquisitions; legal protections for minority shareholders; and the externality choices of incumbents and acquirers.

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1 Introduction

Responsible investment aims to balance financial returns with the broader environmental and social (ES) impact of capital allocations. Its effectiveness in shaping corporate policies is a topic of ongoing research and debate,[1] which raises the question of where it is most likely to have meaningful impact. One particularly important setting is the market for corporate control—through mergers, acquisitions, and leveraged buyouts (LBOs). These high-stakes transactions typically require shareholder approval and fundamentally reshape firm operations while generating significant externalities that affect a wide range of stakeholders, including employees, consumers, and the environment.[2] Although a growing body of empirical research and industry surveys suggests that ES considerations are becoming an increasingly important factor in deal-making,[3] a theoretical framework to understand these dynamics has yet to be developed.

In this paper, we develop a model to examine how socially conscious acquirers and targets respond to the externalities generated by takeovers—and whether such considerations enhance or undermine market efficiency. Specifically, we introduce externalities and social preferences into the canonical takeover model of Bagnoli and Lipman (1988). Their model extends the Grossman and Hart (1980) framework by considering a tender offer with a finite number of target shareholders, thereby incorporating strategic interaction and pivotal decision-making.

[1]Several studies find limited impact: Teoh, Welch, and Wazzan (1999) show minimal valuation effects from the South Africa exclusion campaign; Berk and van Binsbergen (2021) argue ES exclusions barely affect capital costs; Gibson et al. (2022) find U.S. institutional investors following responsible investment principles don't improve portfolio ESG scores; and Heath et al. (2023) show ES funds target but don't enhance strong performers. Conversely, other research demonstrates significant effects: Zerbib (2022) reports substantial return premiums from exclusion; Green and Vallee (2023) find bank divestment reduces coal firms' debt and assets; Hartzmark and Shue (2023) show higher financing costs drive negative impact changes in brown firms; and Gantchev, Giannetti, and Li (2022) demonstrate that exit threats following negative ES incidents motivate performance improvements. Additionally, shareholder activism and engagement effectively influence ES policies (Dimson, Karakas, and Li, 2015; Hoepner et al., 2024; Naaraayanan, Sachdeva, and Sharma, 2021; Akey and Appel, 2020; Chen, Dong, and Lin, 2020).

[2]Takeover-related externalities include employment effects such as layoffs (Dessaint, Golubov and Volpin 2017) or improved workplace safety (Cohn, Nestoriak, and Wardlaw 2021); market impacts including increased concentration and reduced consumer welfare (Eckbo 1983; Borenstein 1990) or innovation changesâboth positive (Phillips and Zhdanov 2013) and negative (Cunningham, Ederer, and Ma 2021); environmental consequences like pollution (Bellon 2020); and broader societal effects on free speech (e.g., Musk's Twitter buyout), journalism (Ewens, Gupta, and Howell 2022), education (Eaton, Howell, and Yannelis 2019), and healthcare (Gupta et al. 2021; Liu 2022).

[3]For recent empirical evidence see Duchin, Gao, and Xu (2024); Li, Peng, and Yu (2023); Berg, Ma, and Streitz (2023). For recent surveys see Deloitte 2024 M&A ESG Survey and PwC Responsible Investment Survey.

Importantly, in our model, a takeover affects not only the firm's value but also the externalities it generates—positive or negative. As a result, a takeover may be privately efficient by increasing firm value, yet socially inefficient due to negative externalities, or vice versa. Our framework is also sufficiently flexible to accommodate both consequentialist social preferences and "warm-glow" motivations.

Social preferences over externalities introduce new trade-offs: by accepting a large premium, shareholders sell their cash-flow claims but, in doing so, may facilitate a takeover that generates negative externalities—externalities to which they remain exposed. Similarly, when designing an offer, the bidder considers not only the expected financial returns but also the broader social impact of the takeover.

Despite these additional considerations, the equilibrium characterization remains surprisingly clean: it is characterized by the total surplus generated by the takeover and the *balance* of social preferences between the bidder and the target shareholders. This clarity allows us to explore a wide range of issues, including the trade-offs between socially responsible investing and strict adherence to profit-maximization (Friedman doctrine), the impact of pre-takeover trading with financial investors such as arbitrageurs, the role of payment methods and leverage in acquisitions, legal protections for minority shareholders, and the strategic use of externality choices as a form of takeover defense or a bidding tactic. Our analysis also offers novel predictions about takeover outcomes when investor decisions are shaped by concerns over externalities.

Our first result shows that when the social preferences of target shareholders and the bidder are *balanced*—meaning the externalities that shareholders ignore upon divestment are fully internalized by the bidder upon acquisition—the market for corporate control is efficient: regardless of how dispersed the shareholders are, socially inefficient takeovers are always blocked, and socially efficient takeovers succeed with the same probability as a privately efficient takeover would in the absence of social preferences or takeover externalities.

To build intuition, consider a takeover that is privately efficient but socially inefficient due to negative externalities. One might expect such a takeover to succeed due to free-riding: even a socially responsible shareholder may feel too small to prevent external harm and therefore choose to accept a relatively large premium. However, the classic "holdout" problem identified by Grossman and Hart creates opposing incentives—individual shareholders may prefer to retain their shares and become minority owners in the post-takeover firm and thereby capture the full cash flow improvement. When social preferences are exactly balanced, this holdout incentive offsets the public goods free-rider problem, safeguarding against socially harmful takeovers. The intuition for the success of socially beneficial but privately inefficient takeovers follows a symmetric logic.[4] Overall, when social preferences are balanced, the market for corporate control achieves efficiency.

The efficiency result described above breaks down when social preferences are imbalanced. Specifically, when takeover externalities are negative, socially inefficient takeovers may succeed in equilibrium. Conversely, when externalities are positive, socially efficient takeovers may fail with high probability. Social preferences are imbalanced when, for example, target shareholders have warm-glow preferences while the bidder is profit-maximizing. Warm-glow shareholders prefer to hold in their portfolios firms that generate positive externalities and avoid those that cause harm, affecting their willingness to tender their shares. When a takeover creates negative externalities, the bidder can effectively "threaten" shareholders with those harms—becoming a minority shareholder in a post-takeover firm is particularly undesirable. As a result, shareholders may tender their shares for a lower premium, allowing the bidder to earn positive profits and complete a socially inefficient takeover. In contrast, when a takeover generates positive externalities, shareholders may resist tendering—because remaining a minority shareholder is especially attractive. This forces the bidder to offer a higher premium, eroding their profits and preventing a socially efficient takeover.

More broadly, and perhaps surprisingly, greater social responsibility on the part of shareholders or the bidder can lead to inefficient outcomes. The key intuition is that efficiency depends not only on the extent to which externalities are internalized, but also on the *balance* of social responsibility between target shareholders and the bidder. Our analysis therefore suggests that the social responsibility of the financial sector—including the mandates given to asset managers—should be aligned with that of the corporate sector to promote socially efficient outcomes.

A common argument is that the presence of hedge funds in financial markets can dilute, or even nullify, the impact of responsible investment. To examine this in the context of takeovers,

[4] In this case, the force that offsets the public goods free-rider problem—which might lead a shareholder to reject a modest premium despite positive expected externalities from the takeover—is the "pressure to tender" identified by Bebchuk (1987).

we consider a scenario in which target shareholders may sell their shares to purely financial investors before the takeover occurs. Interestingly, such trades arise in equilibrium, and when social preferences are imbalanced, they can actually enhance social efficiency in the market for corporate control. The intuition is as follows: financial investors, who disregard externalities, are less vulnerable to the threats posed by negative externalities. As a result, they may be more willing to block socially inefficient takeovers that rely on such threats to pressure socially responsible shareholders. At the same time, they are also more likely to support takeovers with positive externalities, as they do not require the excessively high premiums that socially responsible investors might demand. In this way, non-social capital can help correct inefficiencies caused by imbalanced social preferences.

Publicly traded companies sometimes use equity rather than cash as payment in acquisitions. Our model reveals a novel role for payment methods when externalities are present. We show that while the payment method is irrelevant under balanced social preferences, it becomes critical when preferences are imbalanced. Intuitively, if the externalities are negative (positive), shareholders with pure warm-glow preferences dislike (like) holding the target shares and are more (less) willing to accept cash offers, which benefits (harms) the bidder. Equity offers mitigate these effects by preserving shareholders' exposure to externalities through continued ownership in the bidding firm. As a result, bidders prefer cash (equity) offers when the target's externalities are negative (positive). The same logic applies to externalities generated by the bidder's existing operations: cash (equity) offers are optimal if the bidder's own externalities are negative (positive). Our model therefore predicts that bidders generating negative externalities—such as traditional fossil fuel companies—enjoy strategic advantages in takeovers and are more likely to acquire positive-externality targets—such as renewable energy firms—using cash offers.

In practice, bidders often finance acquisitions with debt secured by the target's assets—a common strategy employed by private equity firms in LBOs. Mueller and Panunzi (2004) showed that, absent takeover externalities, leverage improves takeover efficiency by mitigating the holdout problem through the dilution of minority shareholders. Building on this insight, we show that when takeovers generate positive externalities, leverage similarly promotes socially efficient outcomes—even when those takeovers are privately inefficient (i.e., reduce firm value). Thus, our analysis provides a normative justification for relaxing legal protections of minority shareholders when bidders create positive externalities, allowing them to employ higher leverage ratios. Conversely, when takeovers generate negative externalities, leverage can *exacerbate* inefficiencies by facilitating socially inefficient takeovers and potentially deterring efficient ones. In such cases, our findings support the use of targeted leverage caps as a means to strengthen minority shareholder protections and hence market efficiency.

An efficient market for corporate control requires that socially efficient takeovers succeed—even when they are privately inefficient. When social preferences are balanced, such efficiency can arise because some shareholders are willing to tender their shares at a discount, anticipating positive externalities from the takeover. However, legal protections that allow minority shareholders to sue the bidder for post-takeover declines in firm value—if such declines occur—can undermine this mechanism. We show that in the presence of takeover externalities, these protections may backfire and reduce social efficiency. Intuitively, the prospect of post-takeover litigation can discourage socially responsible shareholders from tendering, even when the takeover would yield a socially beneficial outcome.

Finally, post-takeover externalities can be influenced by the bidder's production plans, while pre-takeover externalities are shaped by the incumbent's operational choices. In both cases, there is a trade-off between minimizing negative externalities and maximizing firm value. We endogenize these takeover-related externalities and show that when social preferences are balanced, both the bidder and the incumbent choose socially efficient production plans. In contrast, when preferences are imbalanced, they may adopt socially inefficient strategies. Our analysis thus identifies the conditions under which corporate social (ir)responsibility can be strategically employed—either as an effective bidding tool to enhance acquisition prospects or as a defensive mechanism to deter unwanted takeover attempts.

Overall, our analysis demonstrates that externalities in takeovers and social responsibility have significant positive and normative implications for the market for corporate control.

Related Literature

Our paper is related to two main strands of literature. First, we contribute to the theoretical literature on takeovers. Besides Bagnoli and Lipman (1988), Holmstrom and Nalebuff (1992), Gromb (1993), Cornelli and Li (2002), Marquez and Yılmaz (2008), Dalkır and Dalkır (2014), Dalkır (2015), Ekmekci and Kos (2016), Dalkır, Dalkır, and Levit (2019), and Voss and Kulms (2022) study variants of tender offer models with a finite number of shareholders. Unlike these studies, we examine the effects of takeover externalities and social preferences on the takeover dynamics. Baron (1983), Ofer and Thakor (1987), Harris and Raviv (1988), Bagnoli, Gordon, and Lipman (1989), Berkovitch and Khanna (1990), Hirshleifer and Titman (1990), and Levit (2017) studied various mechanisms through which managers and boards of target companies can resist and influence takeover outcomes. Relative to these papers, we study the circumstances under which social (ir)responsibility can be an effective takeover defense.[5]

Second, we contribute to the theoretical literature on the effects of responsible investment on corporate policies. A growing number of papers studies the effects of portfolio allocations and divestment strategies on corporate policies: Heinkel, Kraus, and Zechner (2001), Davies and Van Wesep (2018), Oehmke and Opp (2024), Edmans, Levit, and Schneemeier (2022), Landier and Lovo (2024), Green and Roth (2024), and Chowdhry, Davies, and Waters (2019), Huang and Kopytov (2022), Gupta, Kopytov and Starmans (2022), Piccolo, Schneemeier, and Bisceglia (2022), Pastor, Stambaugh, and Taylor (2021), Pedersen, Fitzgibbons, and Pomorski (2021), Baker, Hollifield, and Osambela (2022), and Goldstein et al. (2022). Broccado, Hart, and Zingales (2022) and Gollier and Pouget (2022) also study engagement and voting as alternative mechanisms to affect firm's externalities. Relative to this burgeoning literature, we study responsible investment in the context of takeovers. The decision of shareholders to tender can be viewed as combination of exit (selling the firm to the bidder) and voice (influencing who controls the target). Moreover, while the existing literature focuses on the classic free-rider problems in public goods, we highlight its interaction with another well-known free-rider problem, namely, the holdout problem of Grossman and Hart (1980).

[5] A larger body of literature followed Grossman and Hart (1980) and studied various implications and variants of the holdout problem in takeovers when shareholders are infinitesimal: Yarrow (1985), Shleifer and Vishny (1986), Kyle and Vila (1991), Burkart, Gromb, and Panunzi (1998, 2000), Amihud, Kahan and Sundaram (2004), Mueller and Panunzi (2004), Marquez and Yilmaz (2008), Gomes (2012), At, Burkart and Lee (2011), Burkart and Lee (2015, 2022), Burkart, Lee and Petri (2023), and Burkart, Lee and Voss (2024).

2 Model

There are $N \geq 2$ shareholders, indexed by i, each of whom owns a single share in a target firm. Each share carries one vote. A bidder is interested in acquiring the firm and changing its operations. The value of the firm is V_0 under its incumbent management, and will change to V_1 if acquired by the bidder. The firm also produces externalities. The externality is Φ_0 under the incumbent, and will change to Φ_1 if the firm is acquired by the bidder. For use throughout, we define the per-share firm analogues of these quantities: $v_0 \equiv \frac{V_0}{N}, v_1 \equiv \frac{V_1}{N}, \phi_0 \equiv \frac{\Phi_0}{N}$, and $\phi_1 \equiv \frac{\Phi_1}{N}$.

The bidder makes a cash tender offer p per share. The acquisition is successful—and the bidder gains control of the firm—if at least K shares are tendered, where $K < N$. Define $\kappa = \frac{K}{N} \in (0, 1)$; that is, κ is the majority rule. The bidder's offer is conditional on the success of the takeover; if fewer than K shares are tendered, the bidder doesn't acquire any shares and the acquisition fails. If K or more shares are tendered, the bidder buys all tendered shares, the acquisition succeeds, and any shareholders who did not tender retain their shares and become minority holders.[6] Conditional offers of this kind are the most common form of tender offer in practice.[7]

Given the offer p, all shareholders simultaneously decide whether to tender or retain their shares. Let $\gamma_i \in [0, 1]$ denote the endogenously-selected probability that shareholder i tenders.

As discussed in the introduction, our goal is to study the consequences of shareholders taking seriously the externalities generated by a firm. Accordingly, we assume that a shareholder's utility from holding a share depends not only on its financial value but also on the associated externalities, weighted by a parameter $\alpha \in [0, 1]$ that captures the extent to which investors internalize these externalities. Specifically, a shareholder's utility from holding a share is $v_0 + \alpha\phi_0$ if the incumbent retains control, and $v_1 + \alpha\phi_1$ if the bidder acquires the firm.

From the perspective of an individual shareholder, an acquisition creates surplus

$$s \equiv v_1 + \alpha\phi_1 - v_0 - \alpha\phi_0. \tag{1}$$

Throughout, we label acquisitions with $s > 0$ as *socially efficient* and those with $s < 0$

[6]See Online Appendix H for an extension of the baseline model that allows for freeze-out mergers.

[7]Equilibrium takeover probabilities and payoffs are largely unchanged if unconditional offers are used instead.

as *socially inefficient*.[8] Similarly, we label acquisitions with $v_1 > v_0$ as *privately efficient* and those with $v_1 < v_0$ as *privately inefficient*. We assume $s \neq 0$ in order to avoid this economically insignificant boundary case. Analogous to other notation, define $S = Ns$.

Shareholders may care more about the externalities generated by firms they still own than by those they have divested from. We capture this with the parameter $\eta \in [0, \alpha]$. Specifically: if an acquisition succeeds then each tendering shareholder receives utility $p + \eta\phi_1$. That is, if $\eta < \alpha$ then shareholders have what are commonly referred to as *warm-glow* preferences.[9] In contrast, if $\eta = \alpha$ then shareholders' internalization of externalities is unrelated to share ownership, consistent with fully consequentialist preferences.[10]

The bidder (or its shareholders) internalizes both the financial impact of the takeover on the firm's value and any associated externalities. Formally, the bidder's payoff per share acquired in a successful takeover is given by $v_1 - p + \delta\phi_1$, where $\delta \geq 0$ represents the degree of the bidder's social responsibility.[11] Note that the model of Bagnoli and Lipman (1988) is a special case in which $\alpha = \eta = \delta = 0$, or alternatively $\Phi_0 = \Phi_1 = 0$.

We focus on symmetric Nash equilibria, as standard in the literature, and denote the equilibrium offer and tendering strategy by (p^*, γ^*). If the bidder is indifferent between making an offer at price p and not bidding at all, we assume the bidder refrains from bidding—reflecting, for instance, the presence of infinitesimal bid preparation costs.

Before proceeding, we highlight the two key respects in which a firm's externalities (Φ_0, Φ_1) conceptually differ from its cash flows (V_0, V_1). First, tendering shareholders do not care about post-acquisition cash flows V_1, but (provided $\eta > 0$) they do care about post-acquisition externalities Φ_1. Second, the bidder's weights on cash flows V_1 and externalities Φ_1 generally

[8] In adopting this labeling, we are implicitly assuming that α is sufficiently close to 1 that the sign of s coincides with the sign of the overall surplus associated with the acquisition, $V_1 + \Phi_1 - V_0 - \Phi_0$. We regard this as the right starting point for our analysis, since it corresponds to assuming that if shareholders could perfectly coordinate then they would reach the socially optimal decision. Our analysis characterizes the distortions from this benchmark that are created by decentralized decision-making and by preference shifts associated with transferring share ownership.

[9] The term "warm-glow" is most appropriate when externalities are positive ($\phi_1 > 0$). When externalities are negative ($\phi_1 < 0$), these preferences would be described as "cold-prickle."

[10] If $\eta > \alpha$, shareholders internalize externalities more when selling than when retaining ownership—potentially reflecting a sense of responsibility for outcomes they have actively contributed to. Our framework accommodates such cases, though we do not explore them in detail.

[11] The bidder's social preferences resemble warm-glow preferences, in the sense that the bidder only internalizes externalities if the acquisition succeeds and only in proportion to the shares acquired. See Online Appendix I for an alternative formulation in which the bidder exhibits consequentialist preferences.

differ from target shareholders' weights.

3 Analysis

3.1 Preliminaries

We begin by introducing notation and key identities that will be useful in the analysis that follows. Consider the decision of an individual shareholder i, taking as given that each of the other $N-1$ shareholders tenders with probability $\gamma \in [0,1]$. If shareholder i retains his/her share then the probability of a successful acquisition is

$$q(\gamma) \equiv \sum_{j=K}^{N-1} \binom{N-1}{j} \gamma^j (1-\gamma)^{N-1-j}. \tag{2}$$

Similarly, the probability that shareholder i's tendering decision is pivotal is

$$\Delta(\gamma) \equiv \binom{N-1}{K-1} \gamma^{K-1} (1-\gamma)^{N-K}. \tag{3}$$

Hence $q+\Delta$ is the probability of a successful acquisition if shareholder i tenders.

Consequently, if all shareholders tender with probability γ then the acquisition succeeds with probability

$$\Lambda(\gamma) \equiv (1-\gamma) q + \gamma (q+\Delta) = q + \gamma\Delta, \tag{4}$$

To enhance readability we generally suppress the argument γ in the functions q, Δ, and Λ.

3.2 Benchmark: No externalities, $\phi_0 = \phi_1 = 0$

As a benchmark, consider the case in which the target firm doesn't generate any externalities under either the incumbent or bidder. In this case, the social preferences of both the bidder and the shareholders are irrelevant.

Proposition 1 *Suppose $\phi_0 = \phi_1 = 0$. There is a unique equilibrium. The tendering probability is $\gamma^* = 0$ if $v_1 < v_0$ and is $\gamma^* = \kappa$ if $v_1 > v_0$.*

This benchmark case is covered by Bagnoli and Lipman (1988). Privately inefficient acquisitions always fail, while privately efficient acquisitions succeed with a probability strictly between 0 and 1—and converging to $1/2$ as the number of shareholders $N \to \infty$. Bagnoli and Lipman also establish that as the target's ownership becomes increasingly dispersed the bidder's profits converge to zero, reflecting the holdout problem in takeovers. In what follows, we examine how social preferences over externalities change these conclusions.

3.3 Tendering decisions

We start by analyzing the tendering subgame given an offer price p. We again consider the utility of an individual shareholder i as a function of that shareholder's tendering decision, taking as given that all $N-1$ other shareholders tender with probability γ. If shareholder i retains, the acquisition succeeds with probability q, and shareholder i's expected utility is

$$v_0 + \alpha\phi_0 + q\left(v_1 + \alpha\phi_1 - v_0 - \alpha\phi_0\right), \tag{5}$$

reflecting that if the acquisition succeeds then the shareholder benefits from the full post-takeover value of the firm as a minority shareholder, along with the externalities generated by the acquisition. If instead shareholder i tenders, the acquisition succeeds with probability $q+\Delta$, and shareholder i's expected utility is

$$v_0 + \alpha\phi_0 + (q+\Delta)\left(p + \eta\phi_1 - v_0 - \alpha\phi_0\right). \tag{6}$$

This expression reflects both the fact that offer is conditional and so shareholder i receives p only with probability $q+\Delta$; and also that because tendering involves divestment, the weight placed on externalities drops from α to $\eta \leq \alpha$.

Consequently, shareholder i's net gain from tendering is

$$\tau\left(\gamma; p\right) \equiv \Delta s - (q+\Delta)\left(v_1 + (\alpha-\eta)\,\phi_1 - p\right). \tag{7}$$

Equation (7) is simple but marks an important first step in our analysis: the act of tendering is isomorphic to making a public-good contribution. By tendering, a shareholder effectively contributes Δs to overall surplus. The cost of this contribution corresponds to the foregone private value identified by Grossman and Hart, namely $v_1 - p$, adjusted for $(\alpha - \eta)\,\phi_1$, the change in the shareholder's concern for externalities resulting from divesting the share.

In particular, if post-acquisition externalities are negative ($\phi_1 < 0$) then shareholders with warm-glow preferences ($\eta < \alpha$) are more inclined to tender than otherwise, because doing so relieves them of responsibility for negative externalities. Conversely, if post-acquisition externalities are positive ($\phi_1 > 0$), warm-glow shareholders find retention more attractive than otherwise, since tendering would prevent them from benefit from the acquisition's social benefit.

Expression (7) highlights that a shareholder's total utility from a successful acquisition, $v_1 + \alpha\phi_1$, *isn't* a sufficient statistic for the gain to tendering τ. The economic reason is that, provided that $\eta > 0$, tendering shareholders care about the externalities ϕ_1 generated by the acquisition, but they don't care about the cash flows v_1.

Equilibrium of tendering subgame

In the tendering subgame, $\gamma^* = 0$ is an equilibrium if $\tau\,(0; p) \leq 0$; $\gamma^* = 1$ is an equilibrium if $\tau\,(1; p) \geq 0$; and $\gamma^* \in (0, 1)$ is an equilibrium if

$$\tau\,(\gamma^*; p) = 0. \tag{8}$$

The tendering subgame potentially has multiple equilibria. For example, if $K > 1$ then everyone-retains ($\gamma^* = 0$) is an equilibrium, regardless of the offer p. We impose the following standard stability criterion, which reduces (though does not eliminate) equilibrium multiplicity:

Stability condition: An equilibrium γ^* of the tendering subgame is stable if for all $\epsilon > 0$ sufficiently small: either $\gamma^* = 0$ or $\tau\,(\gamma^* - \epsilon; p) > 0$; and either $\gamma^* = 1$ or $\tau\,(\gamma^* + \epsilon; p) < 0$.

In words: an equilibrium is stable if a small increase (decrease) in the tendering probability of $N - 1$ shareholders makes tendering less (more) attractive for the remaining shareholder. Hereafter, we refer to a stable equilibrium simply as equilibrium.

Lemma 1 *An equilibrium γ^* of the tendering subgame exists. For socially inefficient acquisitions ($s < 0$)*

$$\gamma^* = \begin{cases} 0 & \text{if } p \leq v_1 + (\alpha - \eta)\,\phi_1 \\ \{0,1\} & \text{if } p \in (v_1 + (\alpha - \eta)\,\phi_1, v_1 + (\alpha - \eta)\,\phi_1 - s) \\ 1 & \text{if } p \geq v_1 + (\alpha - \eta)\,\phi_1 - s. \end{cases} \tag{9}$$

For socially efficient acquisitions ($s > 0$), define

$$\mu(\gamma) \equiv v_1 + (\alpha - \eta)\,\phi_1 - \frac{\Delta}{q + \Delta} s; \tag{10}$$

then

$$\gamma^* = \begin{cases} 0 & \text{if } p \leq v_1 + (\alpha - \eta)\,\phi_1 - s \\ \mu^{-1}(p) \in (0,1) & \text{if } p \in (v_1 + (\alpha - \eta)\,\phi_1 - s, v_1 + (\alpha - \eta)\,\phi_1) \\ 1 & \text{if } p \geq v_1 + (\alpha - \eta)\,\phi_1. \end{cases} \tag{11}$$

As one would expect, the tendering probability γ^* is increasing in the offer p. In particular, all shareholders tender if the bidder offers p in excess of the post-acquisition value of the firm v_1, adjusted by the shift-in-preferences term $(\alpha - \eta)\,\phi_1$.

If the acquisition is socially efficient ($s > 0$) then a mixed-strategy equilibrium arises for moderate offers. In this case, shareholders are indifferent between tendering and retaining their shares, i.e., $\tau(\gamma^*; p) = 0$.

In contrast, if the acquisition is socially inefficient ($s < 0$) then a mixed-strategy equilibrium doesn't exist. Instead everyone-retaining ($\gamma^* = 0$) and everyone-tendering ($\gamma^* = 1$) coexist as equilibria for moderate offers

$$p \in (v_1 + (\alpha - \eta)\,\phi_1, v_1 + (\alpha - \eta)\,\phi_1 - s). \tag{12}$$

From (7), this case is the reverse of the well-known holdout problem. Specifically, the individual cost of tendering is the increased probability of an undesirable acquisition with $s < 0$ occurring; while the individual benefit is that a shareholder receives p instead of the preference-shift-adjusted post-acquisition value $v_1 + (\alpha - \eta)\,\phi_1$ in a successful acquisition. Consequently, if an individual shareholder anticipates a low acquisition probability then retention dominates tendering, while the reverse is true if a high acquisition probability is anticipated. The everyone-tenders equilibrium is a manifestation of Bebchuk's (1987) "pressure to tender" effect. In our context, it arises precisely because of preferences over social externalities; absent externalities, the case arises only if the offer p exceeds the post-acquisition value v_1, but bidders would never make such an offer.

Looking ahead (Proposition 2), the tendering subgame has multiple equilibria even once the bidder's offer is endogenized. This stands in sharp contrast to the case without externalities ($\phi_0 = \phi_1 = 0$, Proposition 1), in which case the multiplicity condition (12) never holds in equilibrium. Consequently, shareholder's social concerns about externalities lead to variation in takeover outcomes, even after fully controlling for bidder, target and deal characteristics.

3.4 Bidder's payoff

The bidder's expected payoff from making an offer to an individual shareholder—conditional on that shareholder tendering and all other shareholders following strategy γ—is

$$(q + \Delta)(v_1 - p + \delta\phi_1). \tag{13}$$

That is, in the probability $q+\Delta$ event that the acquisition succeeds, the bidder makes a profit of $v_1 - p$ per share, along with additional warm-glow utility of $\delta\phi_1$. If instead the acquisition fails the bidder's payoff is zero, because the offer is conditional. Given that each shareholder tenders independently with probability $\gamma \in (0, 1)$, and there are N shareholders making independent decisions, the bidder's expected total payoff is simply $N\gamma$ times the expected payoff (13), i.e.,

$$N\gamma(q + \Delta)(v_1 - p + \delta\phi_1). \tag{14}$$

Naturally, the bidder's profits depend on the spread between the post-acquisition cash flows v_1 and the offer p. From (7), this same spread affects each target shareholder's gain τ from tendering. Consequently, whenever the equilibrium condition (8) holds, the bidder's expected profit is

$$\pi(\gamma) \equiv N\gamma\Delta s + N\gamma(q + \Delta)(\delta + \eta - \alpha)\phi_1. \tag{15}$$

To understand (15) it is helpful to consider first the case of target shareholders with consequentialist preferences ($\eta = \alpha$) and a bidder motivated purely by profit ($\delta = 0$). In this case, (15) reduces to simply its first term

$$\pi(\gamma) = N\gamma\Delta s. \tag{16}$$

As we noted above, the post-acquisition cash flows v_1 and externalities ϕ_1 have different "exclusion" characteristics: tendering shareholders are excluded from v_1, leading to the holdout problem, but aren't excluded from ϕ_1. The important implication of (7) is that, nonetheless, both components of a target shareholder's preferences can be mapped into a general public-good contribution setting, in which a target shareholder compares the benefit from a contribution to the public good, Δs, with the cost, $(q + \Delta)(v_1 - p)$. In particular, for any given tendering probability γ, the acquisition surplus s directly determines the spread $v_1 - p$ that the bidder makes on each share acquired.

The second term in (15) can be understood by considering perturbations away from the benchmark just described. Bidder preferences over externalities ($\delta > 0$) increase the bidder's profits exactly as one would expect. Perhaps less immediate, warm-glow preferences for target shareholders ($\alpha > \eta$) force the bidder to increase its offer if post-acquisition externalities ϕ_1 are positive, since shareholders have a direct incentive to retain their shares in this case.

The bidder's profits equal expression (15) only if tendering shareholders are indifferent between tendering and retention. More generally, the bidder's expected total payoff is

$$\Pi(\gamma; p) = \begin{cases} \gamma\Delta S + \gamma(q + \Delta)(\delta + \eta - \alpha)\Phi_1 & \text{if } \gamma \in [0, 1) \\ V_1 - p + \delta\Phi_1 & \text{if } \gamma = 1. \end{cases} \tag{17}$$

We let Π^* be the bidder's expected profit in equilibrium.

4 Equilibrium acquisition probabilities

The equilibrium of the overall game follows from the characterization in (17) of the bidder's payoff.

Proposition 2

Socially inefficient acquisitions, $s < 0$: If $s \leq (\alpha - \eta - \delta)\,\phi_1$ then $\gamma^* = 0$ is an equilibrium. If $(\alpha - \eta - \delta)\,\phi_1 < 0$, then $\gamma^* = 1$ is an equilibrium. No other equilibrium exists.

Socially efficient acquisitions, $s > 0$: There is a unique equilibrium:

(a) *If $(\alpha - \eta - \delta)\,\phi_1 < 0$ then $\gamma^* > \kappa$, and $\Lambda^* \to 1$ as $N \to \infty$.*

(b) *If $(\alpha - \eta - \delta)\,\phi_1 = 0$ then $\gamma^* = \kappa$, and $\Lambda^* \to (0, 1)$ as $N \to \infty$.*

(c) *If $(\alpha - \eta - \delta)\,\phi_1 > 0$ then $\gamma^* < \kappa$, and $\Lambda^* \to 0$ as $N \to \infty$.*

Proposition 2 has several interesting implications, which we present as a series of corollaries—each effectively a special case.

4.1 Balanced preferences: $\eta + \delta = \alpha$

We first consider the case in which shareholders' and the bidder's social preferences exactly balance out, $\eta + \delta = \alpha$. That is, any externalities that shareholders ignore upon divestment (because $\eta \leq \alpha$) are picked up by the bidder (since $\delta = \alpha - \eta$). This case serves as an important benchmark, and elucidates economic forces that shape outcomes more generally. A leading case in which balanced preferences arise is that of target shareholders with fully consequentialist preferences ($\eta = \alpha$) and a purely profit-motivated bidder ($\delta = 0$).

Corollary 1 *If $\eta + \delta = \alpha$ then socially inefficient acquisitions always fail ($\gamma^* = \Lambda^* = 0$) while socially efficient acquisitions frequently succeed ($\gamma^* = \kappa$ and $\Lambda^* \to 1/2$ as $N \to \infty$).*

For intuition, consider the leading case just noted of consequentialist shareholders and a profit motivated bidder ($\eta - \alpha = \delta = 0$). Corollary 1 first says that, no matter how dispersed shareholders are, a socially inefficient takeover is always blocked. To better understand this result, consider a takeover that is privately efficient ($v_1 > v_0$) but sufficiently socially costly ($\phi_1 < \phi_0$) that $s < 0$. One might initially expect successful bids in such cases, reasoning that shareholders face a free-rider problem: even socially responsible shareholders might reason that individually they have little power to prevent the negative externality and thus prefer to accept the a premium offer $p > v_0$.However, tendering a share is subject to the well-known holdout problem—itself a free-rider problem—in which an individual shareholder is tempted to keep their share, become a minority shareholder in the acquired firm, and benefit from the increase in private value $v_1 - v_0$ rather than accept the smaller bid premium $p - v_0$. Corollary 1 thus establishes that the holdout problem in takeovers safeguards against the free-rider problem in social externalities (public good provision).

Corollary 1 further says that socially efficient acquisitions succeed with exactly the same probability as a privately efficient acquisition would in the absence of social preferences over acquisition externalities. To better understand this result, consider the opposite scenario from that discussed above: a privately inefficient takeover ($v_1 < v_0$) that nonetheless generates sufficient social benefits ($\phi_1 > \phi_0$) so that overall surplus is positive ($s > 0$). Because the bidder is profit-motivated, certainly the offer p is below v_1, which is in turn below v_0. Consequently, one might initially expect that the acquisition would fail, on the grounds that even socially responsible shareholders might individually reason that they little ability to affect the acquisition's success, and hence no reason to bear the individual cost of accepting an offer $p < v_0$ in order to contribute to the public good. But this reasoning is incorrect, and the acquisition has significant probability of success. The reason lies in the flip side of the classic holdout problem—what Bebchuk (1987) describes as the "pressure to tender." Individual shareholders fear that if they do not tender and the acquisition succeeds then they will be left holding a share in a less valuable company (valued at $v_1 < v_0$). This creates strong incentives to tender; in particular, it means that shareholders even when the offered premium is minimal or negative.

These arguments generalize to any case in which the warm-glow preferences of the bidder and shareholders are balanced in the sense $\eta + \delta = \alpha$. Corollary 1 can be summarized as saying that externalities are fully internalized; the market for corporate control operates as efficiently as it would have absent any externalities. Specifically, the market for corporate control facilitates socially efficient acquisitions even if they are privately inefficient, and preventing socially inefficient acquisitions even if they are privately efficient.[12]

[12] When $\eta + \delta = \alpha$, it turns out that there is an easy way to map the standard setting without social externalities to the case of social externalities. Consider two sets of parameters: $(\bar{v}_0, \bar{v}_1, \bar{\phi}_0, \bar{\phi}_1)$ and $(\tilde{v}_0, \tilde{v}_1, \tilde{\phi}_0, \tilde{\phi}_1)$ where $\bar{\phi}_0 = \bar{\phi}_1 = 0$, $\tilde{v}_0 + \alpha\tilde{\phi}_0 = \bar{v}_0$ and $\tilde{v}_1 + \alpha\tilde{\phi}_1 = \bar{v}_1$. That is: the "bar" parameters correspond to the standard case without social externalities, and the "tilde" parameters introduce social externalities while leaving the combination of pecuniary and social value unchanged. Consider an arbitrary offer by the bidder, $\bar{p}$, made under the bar parameters. From (10), an offer $\tilde{p} = \bar{p} - \eta\tilde{\phi}_1$ made under the the tilde parameters induces exactly the same tendering behavior as the offer $\bar{p}$ under the bar parameters. Moreover, the bidder's payoff is also exactly the same in the two cases: if the offer is rejected, its payoff is 0 in both cases, while if the offer is accepted, the offer $\tilde{p}$ entails paying $\eta\tilde{\phi}_1 = \alpha\tilde{\phi}_1 - \delta\tilde{\phi}_1$ less for a firm that generates $\alpha\tilde{\phi}_1$ less of pecuniary value but $\delta\tilde{\phi}_1$ more

A final point to note is that, precisely because social externalities are effectively internalized, the bidder's expected profit approaches zero as shareholder dispersion grows large:

$$\Pi^* \to 0 \text{ as } N \to \infty \tag{18}$$

This is immediate from (17); as N grows large, the probability Δ that an individual shareholder is pivotal converges to 0. Economically, the bidder's limited ability to profit from an acquisition is a manifestation of the holdout problem. Our contribution is to show that this result extends to the case of social preferences over externalities.

4.2 Weak warm-glow preferences, $\eta + \delta < \alpha$

In contrast to the generally positive outcomes that emerge when shareholder and bidder social preferences are balanced, equilibrium outcomes are much less desirable when preferences are imbalanced. We consider first the case in which shareholders' and the bidder's warm glow preferences are weak:

Corollary 2 *If $\eta + \delta < \alpha$, then as $N \to \infty$ acquisitions with positive externalities $\phi_1 > 0$ fail, $\Lambda^* \to 0$; and acquisitions with negative externalities $\phi_1 < 0$ potentially succeed: there is a sequence of equilibria in which $\Lambda^* \to 1$, and this sequence is unique if $s > 0$.*

Corollary 2 highlights the outsized role of post-acquisition externalities ϕ_1 in determining the success of an acquisition, along with the perverse consequences that follow. Some socially inefficient takeovers ($s < 0$) potentially succeed with high probability, while some socially efficient takeovers ($s > 0$) always fail as shareholder dispersion grows large. This is especially clear when the status quo is associated with zero social externalities ($\phi_0 = 0$). In this case, takeovers that are socially destructive ($\phi_1 < 0$) occur, while takeovers that are socially beneficial ($\phi_1 > 0$) are blocked, independent of either the private ($v_1 - v_0$) or social (s) value created. Indeed, Corollary 2 predicts that firms that produce negative externalities will be acquired even absent any change in either pecuniary value creation or in social externalities (i.e., $v_1 = v_0$ and $\phi_1 = \phi_0 < 0$).

of warm-glow utility.

To understand these observations, notice that the relative weakness of combined warm-glow preferences ($\delta + \eta < \alpha$) means that an acquisition reduces the aggregate extent to which externalities are internalized. If $\phi_1 < 0$, then socially-minded shareholders dislike holding the share; and importantly, if $\eta < \alpha$, this dislike is alleviated by getting rid of the share. This effect gives shareholders a direct motive to tender, in turn allowing the bidder to reduce its bid. If the bidder's own aversion to negative externalities is small, that is, $\delta < \alpha - \eta$, then the discount the bidder can extract is enough to compensate for the exposure to the target's negative externalities, thereby facilitating the acquisition even if it's socially inefficient.

Importantly, the direct motive to tender that arises from warm-glow preferences and negative post-takeover externalities operates regardless of whether or not an individual shareholder is pivotal. Hence, the bidder can extract a discount from shareholders even when shareholders are arbitrarily dispersed, i.e., $N \to \infty$. At the same time, the holdout and public-good free-rider problems prevent the bidder from benefiting significantly from any social value (s) created. Consequently, the discount that the bidder obtains from warm-glow shareholders' direct motive to tender dominates when shareholders are sufficiently dispersed. In particular, the equilibrium payoff Π^* approaches $\max\{0, (\delta + \eta - \alpha)\, \Phi_1\}$ as $N \to \infty$. That is, if $\phi_1 < 0$ then the bidder's payoff is strictly positive even when the target's ownership is widely dispersed. Note that this result is not driven by the bidder's social preferences per se; even if the bidder is purely profit-maximizing ($\delta = 0$), their profit remains strictly positive in the limit.

The case of positive post-takeover externalities ($\phi_1 > 0$) is directly analogous. In this case, warm-glow preferences induce a direct motive for shareholders to *retain* shares. To overcome this, a bidder would have to offer a large premium. But when shareholders are dispersed, the holdout and public-goods free-riding problems imply that the bidder derives little benefit from the value created by the acquisition. If the bidder's own warm-glow utility from positive externalities is small, $\delta < \alpha - \eta$, the bidder lacks the incentive to offer the premium required to overcome warm-glow shareholders' desire to retain their shares, thereby preventing the acquisition.

4.3 Strong warm-glow preferences, $\eta + \delta > \alpha$

If the combination of shareholders' and the bidder's warm-glow preferences are strong, the conclusions of Corollary 2 are reversed:

Corollary 3 *If $\eta + \delta > \alpha$, then as $N \to \infty$ acquisitions with negative externalities $\phi_1 < 0$ fail, $\Lambda^* \to 0$; and acquisitions with positive externalities $\phi_1 > 0$ potentially succeed: there is a sequence of equilibria in which $\Lambda^* \to 1$, and this sequence is unique if $s > 0$.*

The economic forces underlying Corollary 3 are analogous to those underlying Corollary 2. The most transparent case to consider is that of target shareholders with consequentialist preferences ($\eta = \alpha$) and a bidder with a positive weight on externalities ($\delta > 0$). In this case, and unlike the case of warm-glow preferences ($\eta < \alpha$), shareholders don't derive any direct benefit from offloading shares with negative externalities; nor do they experience any direct reluctance to surrender shares with positive externalities. When shareholders are sufficiently dispersed the decisive factor becomes the bidder's preference for positive externalities. Consequently, acquisitions yielding negative externalities ($\phi_1 < 0$) fail while those yielding positive externalities ($\phi_1 > 0$) potentially succeed. These observations extend to the case in which target shareholders have warm-glow preferences $\eta < \alpha$, but the bidder's own preferences more than offset that gap between η and α.

4.4 Bidder's choice of acquisition characteristics

So far we have taken the acquisition's effect on the target as given, by specifying v_1 and ϕ_1 exogenously. What if instead a bidder has some ability to commit to post-acquisition policies, and in particular, to the trade-off between maximizing cash flows v_1 and maximizing broader social value ϕ_1? Formally, the bidder faces a technologically determined choice set

$$\left\{ (v_1(\tilde{\phi}_1), \tilde{\phi}_1) \right\} \tag{19}$$

of feasible combinations of cash flows and externalities.

Proposition 2 easily extends to deliver implications for this question.[13] Consistent with

[13] The analysis is a straightforward implication of Proposition 2, and thus, we relegate formal details to Online Appendix C.

intuitions from Corollaries 1-3, under balanced social preferences the bidder pledges the socially efficient level of externalities, i.e., maximizes $v_1(\tilde{\phi}_1) + \alpha\tilde{\phi}_1$ subject to technological feasibility. In contrast, if combined warm-glow preferences are weak ($\eta + \delta < \alpha$) the bidder tilts its post-acquisition plans towards worse externalities than the socially efficient level, i.e.,

$$\phi_1 < \arg\max_{\tilde{\phi}_1} v_1(\tilde{\phi}_1) + \alpha\tilde{\phi}_1. \tag{20}$$

In particular, the bidder raises its profits by pledging negative post-acquisition externalities $\phi_1 < 0$, for the reasons covered by Corollary 2.

5 Broader effects of social responsibility in takeovers

Our analysis offers novel insights for the desirability of social responsibility in the context of the market for corporate control. We begin by exploring the potential downsides (the "dark side") of social responsibility—through the lens of our baseline model and an extension in which the bidder exhibits consequentialist preferences. We then extend the framework to allow socially responsible shareholders to trade their shares with financial investors prior to the takeover, shedding light on how such market interactions influence takeover outcomes.

5.1 When social responsibility backfires

The comparison between Corollaries 1 and 2 implies that stronger social responsibility can, under certain conditions, undermine the efficiency of the market for corporate control.[14]

This result can be illustrated in several ways. Consider the case in which $s < 0$ and $\delta + \eta = \alpha$. From Corollary 1, socially inefficient acquisitions are blocked. Relative to this starting point, consider an increase either to the extent to which shareholders care about externalities associated with shares they've sold (η), or to the extent that the bidder weights social factors (δ). From Corollary 2, these strong social preferences lead to the possibility that acquisitions with $\phi_1 > 0$ succeed—*even if such acquisitions are socially inefficient* ($s < 0$). In this scenario, greater social responsibility—via an increase in either δ or η—paradoxically facilitates socially undesirable takeovers. Similarly, if $\delta + \eta < \alpha$ then Corollary 2 predicts

[14]Clearly, there are cases where stronger social responsibility leads to improved outcomes.

that socially efficient acquisitions succeed whenever $\phi_1 < 0$. In contrast, if either shareholders or the bidder grow sufficiently more concerned about externalities that $\delta + \eta$ rises above α then such takeovers fail (Corollary 3). Here, too, heightened social responsibility can prove counterproductive by obstructing socially efficient transactions.[15]

Moreover, even an increase in the baseline level of shareholder social responsibility α can lead to worse outcomes—specifically, if α rises but shareholders' weight on externalities associated with shares that they've sold, η, remains unchanged. Consider the case of a socially efficient acquisition with positive post-acquisition externalities ($\phi_1 > 0$). If preferences are balanced ($\eta + \delta = \alpha$) then the acquisition succeeds with strictly positive probability even as $N \to \infty$. However, if the social preference α increases then (by Corollary 2) the acquisition fails, a socially inferior outcome. The economic reason is that the increase in α, unaccompanied by an increase in η, increases the utility cost to target shareholders of tendering their shares.

In sum, greater social responsibility on the part of shareholders (higher η or α) or the bidder (higher δ) can, in some instances, lead to inefficient outcomes. The underlying intuition is that efficiency depends not only on the degree to which externalities are internalized, but also on the *balance* of social responsibility between shareholders and the bidder.

In practice, the majority of public company shares are held by institutional investors who typically do not internalize externalities caused by firms outside their investment portfolios. That is, even if they hold any social preferences, these are typically of the *warm-glow* type (i.e., $\eta = 0$). Our analysis suggests that the social responsibility of the financial sector—including the mandates given to asset managers (captured by α), should be aligned with that of the corporate sector (captured by δ). In particular, the growing dominance of private equity funds in buying-out publicly held "dirty assets" suggests that the market for corporate control may function more efficiently if asset managers on the sell-side similarly prioritize financial returns.[16]

[15]Related, in Online Appendix I, we show that if $\phi_1 < \phi_0$, then the introduction of consequentialist preferences for the bidder reduces the likelihood of socially efficient acquisitions ($s > 0$).

[16]For example, if $\delta = \eta = 0$, $v_1 + \phi_1 < v_0 + \phi_0$, and $\phi_1 < 0$, then social efficiency is higher when $\alpha = 0$ than when $\alpha > 0$.

5.2 Trade with financial investors

A common argument is that the presence of non-social capital in financial market—such as hedge funds or risk arbitrageurs—can dilute or even nullify the impact of responsible investment. We examine this argument within our takeover model, and show that it's incorrect in many important cases.

Specifically, we consider a scenario in which target shareholders may first sell their shares to purely financial investors (i.e., those for whom $\alpha = \eta = 0$). We assume decentralized and frictionless financial markets, where trades occur whenever they generate mutual gains.[17] Once trading concludes, the tender offer proceeds as in the baseline model, with a newly-formed shareholder base that is purely financially motivated. In order to keep our discussion focused we assume the bidder has no social responsibility ($\delta = 0$). The next result summarizes our key takeaway.[18]

Proposition 3 *(a) If $\eta = \alpha$ then no trade occurs. If $\eta < \alpha$ then (b) trade weakly enhances social efficiency if ϕ_1, $v_1 - v_0$, and s all have the same sign; while (c) trade weakly harms social efficiency of ϕ_1 and s have opposite signs.*

Part (a) of Proposition 3 establishes that there are gains from trade between social and financial investors only if social investors have warm-glow preferences ($\eta < \alpha$). Intuitively, if social investors have consequentialist preferences ($\eta = \alpha$) then takeover outcomes are sufficiently close to social efficiency (Corollary 1) that there is no scope for additional gains from trade.

Part (b) of Proposition 3 highlights instances in which trades with financial investors can arise in equilibrium, and when they do, they increase social efficiency. From Corollary 2, if $\eta < \alpha$, then a socially efficient takeover ($s > 0$) that generates positive externalities ($\phi_1 > 0$) is likely to fail when the target firm's shares are held by social investors. This is because warm-glow investors tend to resist selling their shares under such circumstances. Moreover, if the takeover is both privately and socially efficient ($v_1 > v_0$), the takeover succeeds with

[17] Financial markets may or may not be subject to the same frictions that affect the market for corporate control. Our analysis should therefore be interpreted as an *upper bound* on the impact of trade with financial investors.

[18] Note that the cases described aren't exhaustive; the proof covers all cases.

higher probability when the target shares are instead held by financial investors. In this case, whenever trade occurs,[19] it enhances social efficiency.[20]

Part (c) of Proposition 3 covers cases in which trade with financial investors harms social efficiency. For example, if a takeover is socially efficient ($s > 0$) and results in negative externalities ($\phi_1 < 0$), then it succeeds with high probability if target shares are held by social investors; because of warm-glow preferences, such investors benefit from divesting their shares in a tender offer. If shares are instead held by financial investors then, even if the takeover is also privately efficient ($v_1 > v_0$), the holdout problem leads to a lower probability of takeover success; and *a fortiori* a privately inefficient takeover has even less probability of success. Trade occurs in these cases even despite harming social efficiency because social investors' warm-glow preferences generate a direct trade surplus to selling shares with negative externalities.[21]

6 Governance and legal implications

In this section, we extend the analysis to incorporate equity offers, leveraged offers, minority shareholder protections, and social responsibility as a takeover defense.

6.1 Equity offers

If the bidding company is publicly traded, it may use its own equity as payment—for example, by issuing and exchanging $e > 0$ shares of the bidding firm for each tendered target share. Unlike cash offers, successful equity offers grant tendering shareholders ownership in the bidding firm, exposing them to externalities generated by the combined entity—an effect particularly relevant when shareholders exhibit warm-glow social preferences. This mechanism reveals a

[19] Trade occurs whenever the social surplus s takes on a sufficiently large positive or negative values.

[20] The case of socially inefficient takeovers ($s < 0$) with negative externalities ($\phi_1 < 0$) that are also privately inefficient ($v_1 < v_0$) is analogous: any trade that occurs in this setting enhances socially efficiency because there is an equilibrium in which the takeover succeeds if target shares are held by social investors but it is always blocked when held by financial investors.

[21] Analogously, a socially inefficient takeover that results in positive externalities is blocked by social investors, but succeeds with significant probability if it is privately efficient and shares are held by financial investors; again, trade reduces social efficiency, and again, trade nonetheless occurs if negative externalities generated under incumbent management ($\phi_0 < 0$) make share ownership costly for social investors with warm-glow preferences.

novel role for payment methods in takeovers when externalities are present.[22]

In Online Appendix D, we analyze equity offers and show that if social preferences are balanced, the payment method is irrelevant: the bidder obtains identical expected payoffs under optimal cash and equity offers. However, when preferences are imbalanced, the payment method becomes critical.

To see the intuition, suppose shareholders have pure warm-glow preferences ($\eta = 0$) and $\delta < \alpha$. Corollary 2 shows that if $\Phi_1 < 0$ ($\Phi_1 > 0$) then socially minded shareholders dislike (like) holding the shares. As a result, they are more eager (reluctant) to tender their shares in cash offers, increasing (decreasing) the bidder's expected payoff. In contrast, under equity offers, socially minded shareholders retain exposure to post-takeover externalities through continued ownership in the bidding firm. If the bidding firm generates no externalities of its own, equity offers attenuate shareholders' heightened incentives to tender (retain) their shares. The bidder can exploit this asymmetry by choosing cash offers when $\Phi_1 < 0$ and equity offers when $\Phi_1 > 0$.

If the bidding firm generates externalities Φ_B, equity offers expose tendering shareholders to both to Φ_B and Φ_1, with relative weights depending on the exchange ratio e. Following the logic above, if Φ_B is sufficiently negative (positive), it dominates post-takeover externalities. In this case, equity offers become particularly unattractive (attractive), and the bidder optimally chooses a cash (equity) offer. Thus, consistent with the intuition developed in Section 4.4, bidders that generate negative externalities—whether through their existing operations or expected synergies—enjoy strategic advantages in takeover situations. Our model therefore predicts that emerging renewable energy firms (i.e., those with $\Phi_1 > 0$) are likely acquired via cash offers by established fossil fuel companies (i.e., those with $\Phi_B << 0$).

6.2 Leveraged offers

In practice, bidders often finance acquisitions with debt collateralized against the target's assets—a common strategy in leveraged buyouts (LBOs), particularly among private equity firms. To examine the effects of such leverage offers in the presence of externalities, suppose the bidder issues debt totaling $Nd > 0$, which becomes the obligation of the target if the takeover succeeds. Since debt is a senior claim, the target share value post takeover is $\max\{v_1 - d, 0\}$.

[22] Transaction costs and deferred capital gains taxes may discourage tendering shareholders from immediately selling the bidder's shares they receive

Legal protections for minority shareholders are typically interpreted to require $v_1 - d \geq v_0$. Accordingly, we assume throughout that $v_1 > v_0$ and $d \in [0, v_1 - v_0]$. The bidder chooses both leverage level d and the offer price p to maximize his payoff.

In Online Appendix E we establish several interesting results. First, leverage can increase the probability that socially efficient takeovers succeed in equilibrium—particularly when the takeover is expected to generate a positive social impact (i.e., when $\phi_1 > \phi_0$). The intuition is that leverage enables the bidder to "tunnel" resources out of the firm at the expense of minority shareholders: conditional on a successful takeover, the bidder obtains the entire leverage proceeds d, which are paid back by the target, yet bears only a portion of the total liability. The reminder falls on the minority shareholders. With a diluted post-takeover equity value, shareholders have stronger incentives to tender. In this way, and consistent with Mueller and Panunzi (2004), leverage helps to mitigate the holdout problem and, in turn, facilitates socially efficient takeovers.[23]

Interestingly, when $v_1 < v_0$, legal protections of minority shareholders prevent the bidder from using leverage, thereby preventing takeovers that are socially efficient but privately inefficient. Our analysis thus provides a normative argument for relaxing these legal constraints—specifically, by allowing bidders who generate positive externalities to take on leverage up to a level $s > v_1 - v_0$. Such flexibility could enable socially desirable takeovers that would otherwise be blocked under strict minority protections.

Second, leverage can reduce the probability socially efficient takeovers succeed in equilibrium, especially when the takeover is expected to have a negative social impact (i.e., when $\phi_1 < \phi_0$). Intuitively, leverage allows the bidder to exert pressure on shareholders to tender, which can increase expected profits but also heightens the risk that shareholders reject the offer entirely. As discussed in Section 3.3, the success of socially inefficient takeovers—once debt is accounted for—is self-fulfilling, which entails a risk of failure. Essentially, the bidder trades

[23]It is noteworthy that leveraged offers and freeze-out mergers function differently as exclusionary mechanisms when takeovers generate externalities. There are two reasons. First, with freeze-out mergers, greater dilution requires a lower initial offer price, which increases tendering probability but reduces offer attractiveness. Leveraged offers provide bidders more flexibility to maximize profits at social efficiencyâs expense. Second, the effectiveness of each mechanism depends critically on the alignment between private and social efficiency. When takeovers are privately inefficient but socially beneficial, legal protections render leveraged offers ineffective while freeze-out mergers remain viable. Conversely, when takeovers are privately efficient but socially harmful, freeze-out mergers lose dilutive power (as shown in Proposition 9 in Online Appendix H) while leveraged offers retain effectiveness.

off two alternatives: (i) low leverage ($d = s$), which yields a higher probability of takeover success but lower profits if the takeover succeeds, versus (ii) high leverage ($d = v_1 - v_0$), which offers higher potential profits but a lower probability of success. When the latter strategy dominates—namely, when $\phi_1 - \phi_0 < 0$—leveraged offers exacerbate inefficiencies. Accordingly, our analysis provides a normative argument for strengthening legal protections by capping leverage for bidders who impose negative externalities, i.e., by requiring $d \leq s$, when $s < v_1 - v_0$.

Third, leverage can increase the probability that socially inefficient takeovers succeed. The ability to take leverage and dilute shareholders enables the bidder to make profit even from socially inefficient takeovers, albeit, at the expense of target shareholders.

Finally, if $\phi_1 = \phi_0 = 0$ then $v_1 > v_0$ implies the takeover is socially efficient and leverage has only positive consequences (if $v_1 < v_0$ then leverage has no effect). In other words, the combination of diluting leverage and negative takeover externalities (i.e., $\phi_1 < \phi_0$) increase the scope for takeover inefficiencies.

6.3 Legal protections for minority shareholders

The contrast between Propositions 1 and 2 highlights that privately inefficient takeovers ($v_1 < v_0$) can succeed only when the shareholders or the bidder exhibit social preferences. In such cases, some shareholders may be willing to sell their shares at a discount—either because they anticipate positive externalities from the takeover, or because they fear the takeover will succeed regardless, leaving them with ownership in a firm that has lower valuations and/or generates negative externalities ("pressure to tender"). Corollary 1 indicates that, under balanced social preferences, allowing privately inefficient takeovers may nonetheless lead to socially efficient outcomes. However, following a successful privately inefficient takeover, minority shareholders, those who refused to sell for offered price, might sue the bidder, seeking compensation for the post-takeover decline in firm value. Can such legal protections for minority shareholders backfire and harm social efficiency?

To study this question, suppose that following a successful takeover—and whenever $v_0 > v_1$—non-tendering shareholders can sue the bidder and demand compensation for their loss.[24]

[24] In Online Appendix F, we consider two alternative scenarios. First, a case in which successful litigation compels the bidder to purchase minority shares at v_0, ensuring that minority shareholders receive a payoff of $v_0 + \eta\phi_1$ instead of $v_1 + \alpha\phi_0$. In this scenario, shareholders with warm-glow preferences may choose not to sue, even when $v_0 > v_1$. Second, a case where successful litigation requires the bidder to compensate minority

Litigation is successful with probability σ. Since distortions already arise under imbalanced social preferences, we focus on cases with balanced social preferences, $\delta + \eta = \alpha$.

In Online Appendix F, we show that such minority protections reduce the probability that socially efficient takeovers ($s > 0$) succeed. In the limit as $N \to \infty$, all takeovers fail—harming both social efficiency and shareholder welfare. Intuitively, anticipating litigation, the bidder expects to compensate minority shareholders at a higher price post-takeover. Because of that, inducing shareholders to tender becomes harder, and in equilibrium, shareholders are less likely to tender and the takeover is less likely to succeed. And when a takeover does succeed, the likelihood of litigation—and thus total compensation to the minority—increases. The inability of minority shareholders to commit not to sue the bidder following a successful takeover represents another form of miscoordination—one that ultimately harms both shareholder value and social welfare. Thus, our analysis suggests that such protections of minority rights could harm social efficiency.

6.4 Social responsibility as a takeover defense

In Online Appendix G, we study whether social (ir)responsibility can be strategically employed as an effective takeover defense. We extend the model to allow the incumbent to select ϕ_0 prior to the takeover. The corresponding firm value under incumbent control is denoted $v_0(\phi_0)$, reflects the trade-off between profitability and social impact. We analyze two types of incumbents: a shareholder-oriented incumbent, who seeks to maximize the welfare of existing shareholders, and an entrenched incumbent, whose primary objective is to reduce the likelihood of a takeover (and being replaced).

We begin by considering the case of balanced social preferences. As shown in Corollary 1, when preferences are balanced, the bidder seeks the extract the social surplus s from shareholders. To achieve this, the optimal offer maximizes the probability that shareholders are pivotal—a probability that is independent s, provided that $s > 0$. Since the choice of externalities does not affect the success probability of the takeover, the entrenched incumbent is indifferent, whereas the shareholder-oriented incumbent chooses ϕ_0 to maximize the social value under their control, $v_0(\phi_0) + \phi_0$. Consistent with the preceding analysis, balanced social

shareholders $v_0 - v_1$ per share, while the shareholders retain ownership of their shares. In both cases, the qualitative results remain unchanged.

preferences lead to efficiency in the market for corporate control.

This result changes when social preferences are imbalanced. For example, if $\phi_1 < 0$ and $\delta < \alpha - \eta$, the bidder faces a trade-off between extracting the social surplus s—which requires maximizing the probability shareholders are pivotal—and exploiting shareholders' preference to divest from firms that generate negative externalities. The latter requires increasing the tendering probability, which is beneficial to the bidder when his own concern for negative externalities is small. Thus, all else equal, larger social surplus implies a lower γ and a reduced probability of a successful takeover.

Accordingly, an entrenched incumbent can reduce the probability of a takeover by maximizing the social surplus from the takeover, which requires *minimizing* $v_0(\phi_0) + \phi_0$. In contrast, a shareholder-focused incumbent will instead minimize the social surplus from the takeover by maximizing $v_0(\phi_0) + \phi_0$—both because doing so increases the probability that a socially efficient takeover succeeds, and because, if the takeover fails, shareholders benefit directly from higher social value under continued incumbent control. Thus, when social preferences are imbalanced, social irresponsibility can serve as an effective takeover defense, albeit at the expense of shareholder welfare.

7 Conclusion

This paper develops a tractable theoretical framework to study the effects of responsible investment on the market for corporate control. By incorporating social preferences and takeover-generated externalities into a canonical tender offer model, we highlight how the alignment—or misalignment—of social responsibility between acquirers and target shareholders shapes both the efficiency and outcomes of takeovers. A central insight is that market efficiency is not determined solely by the presence of socially responsible investors or bidders, but by the *balance* of their social preferences. When this balance is achieved, the market supports socially desirable outcomes: takeovers that generate positive externalities proceed, while those that cause harm are blocked—even when they are privately profitable.

However, when social preferences are imbalanced—such as when warm-glow shareholders face a profit-maximizing bidder—market outcomes can become inefficient. In such cases, negative externalities can be strategically leveraged to pressure responsible shareholders into tendering, while positive externalities may deter takeovers that would otherwise benefit society.

Our analysis yields several important implications. First, the participation of purely financial investors—often seen as undermining responsible investment—can, in fact, improve the social efficiency of takeover outcomes. Second, equity offers are optimal when target firms generate positive externalities. Third, debt financing can either mitigate or exacerbate inefficiencies depending on the nature of externalities involved. Fourth, the relaxation of legal protections for minority shareholders, which might seem to weaken governance, can support efficient acquisitions. Finally, firms can strategically manipulate externalities—either to resist takeovers or as a means to facilitate acquisition—highlighting a novel role for social responsibility in both takeover defense and bidding strategy.

More broadly, our results suggest that fostering socially efficient outcomes in corporate control markets requires more than promoting responsible investing in isolation. It calls for better alignment between the mandates of financial intermediaries and the objectives of corporate acquirers. By identifying when and how social responsibility can promote or undermine efficiency, our framework contributes to ongoing debates about the role of ESG in capital markets and offers policy-relevant insights into how corporate takeovers might be shaped to better serve societal goals.

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A Proofs of main results

Throughout the appendix we use the following notation:

$$\hat{v}_1 \equiv v_1 + (\alpha - \eta)\,\phi_1. \tag{21}$$

The term $\hat{v}_1$ represents the post-takeover value adjusted for this shift in preferences.

Proof of Lemma 1. Suppose the bidder makes a conditional tender offer p. Rearranging (7), and given the definition of s and $\hat{v}_1$, we can write

$$\tau(\gamma; p) = (p - \hat{v}_1 + s)(q + \Delta) - sq. \tag{22}$$

Auxiliary Lemma 2 in Online Appendix B implies

$$\frac{\partial \tau(\gamma; p)}{\partial \gamma} = \left[(p - \hat{v}_1 + s)\frac{K-1}{\gamma} - s\frac{N-K}{1-\gamma}\right]\Delta. \tag{23}$$

Note that

$$\begin{aligned} \tau(0; p) &= 0 \\ \tau(1; p) &= p - \hat{v}_1. \end{aligned}$$

Since $\tau(0; p) = 0$, non-tendering ($\gamma^* = 0$) is always an equilibrium. Similarly, tendering ($\gamma^* = 1$) is an equilibrium if and only if $p \geq \hat{v}_1$. Finally, a mixed strategy equilibrium with tendering probability $\gamma^* \in (0,1)$ exists if and only if $\tau(\gamma^*; p) = 0$.

From (23), the shape of τ is determined by the following four cases:

(i) τ is increasing then decreasing if $p > \hat{v}_1 - s$ and $s > 0$

(ii) τ is monotonically increasing if $p \geq \hat{v}_1 - s$ and $s < 0$

(iii) τ is decreasing then increasing if $p < \hat{v}_1 - s$ and $s < 0$

(iv) τ is monotonically decreasing if $p \leq \hat{v}_1 - s$ and $s > 0$

Moreover, in the non-monotone cases (i) and (iii) the interior extremum occurs at $\hat{\gamma}(p)$, defined in

$$\hat{\gamma}(p) \equiv \frac{1}{1 + \frac{s}{p - \hat{v}_1 + s}\frac{N-K}{K-1}}. \tag{24}$$

Hence:

$\gamma^* = 0$ is an equilibrium if and only if one of cases (iii) and (iv) holds.

$\gamma^* = 1$ is an equilibrium if and only if $p > \hat{v}_1$, or if $p = \hat{v}_1$ and case (i) holds. Note that if $p = \hat{v}_1$ and $s > 0$ then $p > \hat{v}_1 - s$.

$\gamma^* \in (0,1)$ is a equilibrium if and only if both case (i) holds and $p < \hat{v}_1$. In this case, γ^* is the unique solution to $\tau(\gamma^*; p) = 0$, or equivalently, $\mu(\gamma^*) = p$ where $\gamma^* \in (\hat{\gamma}(p), 1)$.

From the above characterization: if $\gamma^* \in (0,1)$ is an equilibrium then it is unique. Hence the only case in which multiple equilibria exist is if both $\gamma^* = 0$ and $\gamma^* = 1$ are equilibria. Note that if $p = \hat{v}_1 - s$ and $s > 0$ then $p < \hat{v}_1$, and $\gamma^* = 1$ isn't an equilibrium. Similarly, if $p = \hat{v}_1$ and $s > 0$ then $p > \hat{v}_1 - s$ and $\gamma^* = 0$ isn't an equilibrium. Hence $\gamma^* = 0$ and $\gamma^* = 1$ coexist as equilibria if and only if $p \in (\hat{v}_1, \hat{v}_1 - s)$.

Finally, since τ is continuous and increasing in p it follows that γ^* is continuous and increasing in p. Moreover, $\gamma^* \to 0$ as $p \to \hat{v}_1 - s$ and $\gamma^* \to 1$ as $p \to \hat{v}_1$. ■

Proof of Proposition 2. Effectively, the bidder's objective is to maximize

$$\gamma(q + \Delta)(v_1 - p + \delta\phi_1). \tag{25}$$

If $s < 0$ then Lemma 1 implies that γ^* is given by (9). In this case, $\Pi(0) = 0$ and $\Pi(1) = N(v_1 - p + \delta\phi_1)$. Hence if $v_1 - \hat{v}_1 + \delta\phi_1 < 0 \Leftrightarrow (\alpha - \delta - \eta)\phi_1 > 0$, then the bidder's payoff is strictly negative in any equilibrium with $\gamma^* = 1$. In this case, $\gamma = 0$ is the unique equilibrium. Conversely, if $(\alpha - \delta - \eta)\phi_1 \leq 0$ then for any $p \in (\hat{v}_1, \hat{v}_1 - s]$ there is an equilibrium in which the bidder offers p and $\gamma^* = 1$. The bid $p = \hat{v}_1 - s$ guarantees both $\gamma^* = 1$ and a positive payoff for the bidder if $v_1 - (\hat{v}_1 - s) + \delta\phi_1 > 0 \Leftrightarrow s > (\alpha - \eta - \delta)\phi_1$. Hence an equilibrium with $\gamma^* = 0$ exists if and only if $s \leq (\alpha - \eta - \delta)\phi_1$.

Second, if $s > 0$ then Lemma 1 implies that γ^* is given by (11). Offers in $(\hat{v}_1 - s, \hat{v}_1)$ deliver shareholder acceptance probabilities γ satisfying $\mu(\gamma) = p$ and associated bidder's payoff (per share) of

$$\frac{\pi(\gamma)}{N} = \gamma\Delta s + \gamma(q + \Delta)(\delta + \eta - \alpha)\phi_1$$

The offer $p = \hat{v}_1$ delivers a shareholder acceptance probability of $\gamma = 1$ and a bidder payoff of $N(\delta + \eta - \alpha)\phi_1 = \pi(1)$. Recall from Lemma 1 that as p increases over the interval $(\hat{v}_1 - s, \hat{v}_1)$ the shareholder acceptance probability increases continuously from 0 to 1. Hence the bidder effectively picks γ (via choice of offer p) to solve $\max_{\gamma \in [0,1]} \pi(\gamma)$. Rearranging,

$$\frac{\pi(\gamma)}{N} = \gamma(q + \Delta)[s + (\delta + \eta - \alpha)\phi_1] - \gamma q s$$

From Lemma 2,

$$
\begin{aligned}
\frac{\partial\left[\gamma\left(q+\Delta\right)\right]}{\partial\gamma} &= q+K\Delta \\
\frac{\partial\left[\gamma q\right]}{\partial\gamma} &= q+\frac{N-K}{1-\gamma}\gamma\Delta,
\end{aligned}
$$

Hence

$$
\begin{aligned}
\frac{1}{N}\frac{\partial\pi\left(\gamma\right)}{\partial\gamma} &= \left(q+K\Delta\right)\left[s+\left(\delta+\eta-\alpha\right)\phi_1\right]-\left(q+\frac{N-K}{1-\gamma}\gamma\Delta\right)s \\
&= \frac{\kappa-\gamma}{1-\gamma}N\Delta s+\left(\frac{q}{N\Delta}+\kappa\right)N\Delta\left(\delta+\eta-\alpha\right)\phi_1 \qquad (26)
\end{aligned}
$$

Hence

$$
\frac{\partial\pi\left(\gamma\right)}{\partial\gamma}>0\Leftrightarrow\frac{\kappa-\gamma}{1-\gamma}s>\left(\frac{q}{N\Delta}+\kappa\right)\left(\alpha-\eta-\delta\right)\phi_1.
$$

There are three subcases to consider:

- Subcase $\left(\alpha-\eta-\delta\right)\phi_1<0$: There exists $\epsilon>0$ (independent of N) such that $\frac{\partial\pi(\gamma)}{\partial\gamma}>0$ if $\gamma\leq\kappa+\epsilon$. So the bidder chooses $\gamma^*\in\left(\kappa+\epsilon,1\right)$. The success probability approaches 1 as N grows large, while $\Delta\to0$. From Lemma 1, if the bidder offers $p=\hat{v}_1$ then all shareholders tender with probability 1, and so the bidder's payoff is $N\left(v_1+\delta-p\right)=-\left(\alpha-\eta-\delta\right)\Phi_1$. This offer is suboptimal, and so $-\left(\alpha-\eta-\delta\right)\Phi_1$ is a lower bound for the bidder's payoff. Hence the bidder's payoff approaches $-\left(\alpha-\eta-\delta\right)\Phi_1$ as N grows large (which also establishes that $\gamma^*\to1$).

- Subcase $\left(\alpha-\eta-\delta\right)\phi_1=0$: The bidder chooses $\gamma^*=\kappa$. Therefore, $p^*=\mu\left(\kappa\right)$. The takeover success probability is bounded away from both 0 and 1. As N grows large the bidder's payoff Π^* approaches 0.

- Subcase $\left(\alpha-\eta-\delta\right)\phi_1>0$: There exists $\epsilon>0$ (independent of N) such that $\frac{\partial\pi(\gamma)}{\partial\gamma}<0$ if $\gamma\geq\kappa-\epsilon$. So the bidder chooses $\gamma^*<\kappa-\epsilon$. The success probability approaches 0 as N grows large, and the bidder's payoff approaches 0.

Proof of Proposition 3. The proof repeatedly uses the equilibrium characterization of Proposition 2. Let u_{ss} denote the expected utility of a target shareholder with social preferences if all target shares are held by social investors. Let u_{sf} denote the expected utility of a target shareholder with social preferences if all target shares are held by financial investors. Let u_f denote the expected utility of a target shareholder who is a financial investor if all target shares are held by financial investors. We define u_{sf} and u_f so that they don't include any transfers associated with trade between social and financial investors. Let Λ_s and Λ_f be the takeover-success probabilities if shares are held by social and financial investors, respectively. Hence

$$\begin{aligned} u_{ss} &= v_0 + \alpha\phi_0 + \Lambda_s s \\ u_{sf} &= \eta\phi_0 + \Lambda_f \eta (\phi_1 - \phi_0) \\ u_f &= v_0 + \Lambda_f (v_1 - v_0) . \end{aligned}$$

(Note that in writing u_{ss} we make use of the equilibrium condition that a target shareholder is indifferent between tendering and retention.) Trade surplus is

$$\begin{aligned} u_{sf} + u_f - u_{ss} &= \Lambda_f (v_1 - v_0 + \eta (\phi_1 - \phi_0)) + (\eta - \alpha) \phi_0 - \Lambda_s s \\ &= \Lambda_f s + \Lambda_f (\eta - \alpha) \phi_1 + (1 - \Lambda_f) (\eta - \alpha) \phi_0 - \Lambda_s s. \end{aligned}$$

Hence the trade surplus is positive if

$$(\Lambda_f - \Lambda_s) s > (\alpha - \eta) (\Lambda_f \phi_1 + (1 - \Lambda_f) \phi_0) . \tag{27}$$

As discussed in the main text, we characterize outcomes under the assumption that trade occurs if and only trade surplus $u_{sf} + u_f - u_{ss}$ is strictly positive.

First, we show that no trade occurs if $\eta = \alpha$. Specifically, we show that the trade surplus is weakly negative for all combinations of v_0, v_1, ϕ_0 and ϕ_1.

- Case, $v_1 < v_0$ and $s < 0$: $\Lambda_s = \Lambda_f = 0$.
- Case, $v_1 > v_0$ and $s < 0$: $\Lambda_s = 0 < \Lambda_f$.
- Case, $v_1 < v_0$ and $s > 0$: $\Lambda_s > 0 = \Lambda_f$.
- Case, $v_1 > v_0$ and $s > 0$: $\Lambda_s = \Lambda_f > 0$.

In all cases, the LHS of (27) is either zero or negative, while the RHS of (27) is simply 0. Next, consider the case of warm-glow preferences, $\eta < \alpha$.

- Case, $\phi_1 < 0$, $v_1 < v_0$ and $s > 0$: $\Lambda_s > \Lambda_f = 0$. The trade condition holds for some parameters (e.g., ϕ_0 sufficiently negative); and when trade occurs it harms social efficiency.
- Case, $\phi_1 < 0$, $v_1 > v_0$ and $s > 0$: $\Lambda_s > \Lambda_f > 0$. The trade condition holds for some parameters (e.g., ϕ_0 sufficiently negative); and when trade occurs it harms social efficiency.

- Case, $\phi_1 > 0$, $v_1 < v_0$ and $s > 0$: $\Lambda_s > \Lambda_f = 0$. The trade condition holds for some parameters (e.g., ϕ_0 sufficiently negative); and when trade occurs it harms social efficiency.

- Case, $\phi_1 > 0$, $v_1 > v_0$ and $s > 0$: $\Lambda_s < \Lambda_f$. The trade condition holds for some parameters (e.g., ϕ_0 sufficiently negative); and when trade occurs it enhances social efficiency.

- Case, $\phi_1 < 0$, $v_1 < v_0$ and $s < 0$: $\Lambda_f = 0$. $\Lambda_s = 1$ is an equilibrium; and $\Lambda_s = 0$ is an equilibrium if s is sufficiently negative. If $\Lambda_s = 0$ then trade (if it occurs) has no impact on social efficiency. If $\Lambda_s = 1$ then the trade condition holds for some parameters (e.g., ϕ_0 sufficiently negative); and when trade occurs it enhances social efficiency.

- Case, $\phi_1 < 0$, $v_1 > v_0$ and $s < 0$: $\Lambda_f \in (0, 1)$. $\Lambda_s = 1$ is an equilibrium; and $\Lambda_s = 0$ is an equilibrium if s is sufficiently negative. If $\Lambda_s = 0$ then the trade condition holds for some parameters;[25] and when trade occurs it harms social efficiency. If $\Lambda_s = 1$ then the trade condition holds for some parameters (e.g., ϕ_1

- Case, $\phi_1 > 0$, $v_1 < v_0$ and $s < 0$: $\Lambda_s = \Lambda_f = 0$. Trade (if it occurs) has no impact on social efficiency.

- Case, $\phi_1 > 0$, $v_1 > v_0$ and $s < 0$: $\Lambda_s = 0 < \Lambda_f$. The trade condition holds for some parameters (e.g., ϕ_0 sufficiently negative); and when trade occurs it harms social efficiency.

■

The proofs for all additional results and extensions are in the Online Appendix, which is available here.

[25]Specifically: the trade condition is $\Lambda_f s > (\alpha - \eta)(\Lambda_f \phi_1 + (1 - \Lambda_f)\phi_0)$; we know $\phi_0 > \phi_1$, and so trade occurs only if $\Lambda_f s > (\alpha - \eta)\phi_1$; while the $\Lambda_s = 0$ condition is $s \leq (\alpha - \eta)\phi_1$. Since $s < 0$ it is possible to satisfy both inequalities.

Online Appendix for
"(Ir)responsible Takeovers"

B Supplemental results

Lemma 2. *The following identities hold:*

$$\frac{\partial \Delta}{\partial \gamma} = \left(\frac{K-1}{\gamma} - \frac{N-K}{1-\gamma}\right)\Delta \tag{IA1}$$

$$\frac{\partial q}{\partial \gamma} = \frac{N-K}{1-\gamma}\Delta \tag{IA2}$$

Proof. Here, adopt the convention that if $j > N$ then $\binom{N}{j} = 0$. We prove identity (IA1):

$$\begin{aligned}
\frac{\partial \Delta}{\partial \gamma} &= \frac{\partial}{\partial \gamma}\binom{N-1}{K-1}\gamma^{K-1}(1-\gamma)^{N-K} \\
&= \left(\frac{K-1}{\gamma} - \frac{N-K}{1-\gamma}\right)\binom{N-1}{K-1}\gamma^{K-1}(1-\gamma)^{N-K} \\
&= \left(\frac{K-1}{\gamma} - \frac{N-K}{1-\gamma}\right)\Delta.
\end{aligned}$$

We prove identity (IA2):

$$\begin{aligned}
\frac{\partial q}{\partial \gamma} &= \frac{\partial}{\partial \gamma}\sum_{j=K}^{N-1}\binom{N-1}{j}\gamma^{j}(1-\gamma)^{N-1-j} \\
&= \sum_{j=K}^{N-1}\binom{N-1}{j} j\gamma^{j-1}(1-\gamma)^{N-1-j} - \sum_{j=K}^{N-1}\binom{N-1}{j}(N-1-j)\gamma^{j}(1-\gamma)^{N-2-j} \\
&= (N-1)\sum_{j=K}^{N-1}\binom{N-2}{j-1}\gamma^{j-1}(1-\gamma)^{N-1-j} - (N-1)\sum_{j=K}^{N-2}\binom{N-2}{j}\gamma^{j}(1-\gamma)^{N-2-j} \\
&= (N-1)\sum_{j=K-1}^{N-2}\binom{N-2}{j}\gamma^{j}(1-\gamma)^{N-2-j} - (N-1)\sum_{j=K}^{N-2}\binom{N-2}{j}\gamma^{j}(1-\gamma)^{N-2-j} \\
&= (N-1)\binom{N-2}{K-1}\gamma^{K-1}(1-\gamma)^{N-1-K} \\
&= \frac{N-K}{1-\gamma}\binom{N-1}{K-1}\gamma^{K-1}(1-\gamma)^{N-K} \\
&= \frac{N-K}{1-\gamma}\Delta.
\end{aligned}$$

■

Lemma 3. *The ratio* $\frac{q}{\Delta}$ *is strictly increasing in* $\gamma \in (0,1)$.

Proof. We need to show

$$\frac{\partial q}{\partial \gamma}\Delta > q\frac{\partial \Delta}{\partial \gamma}.$$

From Lemma 2, this inequality is equivalent to

$$\frac{N-K}{1-\gamma}\Delta > \left(\frac{K-1}{\gamma} - \frac{N-K}{1-\gamma}\right) q,$$

which is in turn equivalent to

$$\begin{aligned}
\frac{N-K}{1-\gamma}(q+\Delta) &> \frac{K-1}{\gamma}q \Leftrightarrow \\
\frac{N-K}{1-\gamma}\sum_{j=K-1}^{N-1}\tbinom{N-1}{j}\gamma^j(1-\gamma)^{N-1-j} &> \frac{K-1}{\gamma}\sum_{j=K}^{N-1}\tbinom{N-1}{j}\gamma^j(1-\gamma)^{N-1-j} \Leftrightarrow \\
(N-K)\sum_{j=K-1}^{N-1}\tbinom{N-1}{j}\gamma^j(1-\gamma)^{N-1-(j+1)} &> (K-1)\sum_{j=K}^{N-1}\tbinom{N-1}{j}\gamma^{j-1}(1-\gamma)^{N-1-j} \Leftrightarrow \\
(N-K)\sum_{j=K-1}^{N-1}\tbinom{N-1}{j}\gamma^j(1-\gamma)^{N-1-(j+1)} &> (K-1)\sum_{j=K-1}^{N-2}\tbinom{N-1}{j+1}\gamma^{j}(1-\gamma)^{N-1-(j+1)}.
\end{aligned}$$

Hence it is sufficient to establish that, for any $j = K-1, \ldots, N-2$,

$$(N-K)\tbinom{N-1}{j} > (K-1)\tbinom{N-1}{j+1},$$

i.e.,

$$\frac{N-K}{K-1} > \frac{N-1-j}{j+1}.$$

At $j = K-1$ this inequality is equivalent to $\frac{1}{K-1} > \frac{1}{K}$, which indeed holds. Since the RHS is decreasing in j, this completes the proof. ■

C Social responsibility as a takeover offense

Suppose the bidder can credibly commit to social externalities of ϕ_1 prior to making an offer, with the associated pecuniary firm value under bidder control being $v_1(\phi_1)$.[26] Let $\phi_1^{**} \equiv$

[26] We allow $v_1(\phi_0) \neq v_0$ to reflect operational or financial synergies that do not affect social externality levels.

$\arg\max_{\phi_1} v_1(\phi_1) + \alpha\phi_1$ be the externality level that maximizes social value under the bidder's control.[27] We assume $s(\phi_1^{**}) > 0$, ensuring that the takeover would be socially efficient if the bidder selects the socially optimal externality level.

Proposition 4. *The takeover succeeds with positive probability in equilibrium. If $\eta + \delta = \alpha$, then the bidder chooses ϕ_1^{**}, and if $\eta+\delta < \alpha$ ($\eta+\delta > \alpha$), the bidder's choice is smaller (larger) than ϕ_1^{**}.*

Since the takeover succeeds with positive probability, the bidder's choice of ϕ_1 has material consequences.[28] Proposition 4 demonstrates that under balanced social preferences, the bidder pledges the efficient externality level, as these externalities are fully internalized by the counterparties (Corollary 1). Under imbalanced social preferences, however, the bidder's pledge deviates from the social optimum. Specifically, when $\eta + \delta < \alpha$ ($\eta + \delta > \alpha$), the bidder pledges smaller (larger) externalities than socially optimal. This reflects the bidder's strategic use of externalities: with imbalanced preferences, the bidder can credibly threaten shareholders with negative externalities or entice them with positive externalities to secure share tenders (consistent with Corollary 2). Social irresponsibility thus becomes an effective takeover strategy.

Proof of Proposition 4. Let ϕ_1^* be the externality level chosen by the bidder in equilibrium. If $\eta+\delta = \alpha$ then by Corollary 1, if the bidder chooses ϕ_1 such that $s(\phi_1) < 0$ then the bidder's payoff is 0. If instead the bidder chooses ϕ_1 such that $s(\phi_1) > 0$ then the bidder's payoff is $N\kappa\Delta(\kappa)\, s(\phi_1)$. Hence the bidder chooses $\phi_1 = \phi_1^{**}$.

Next consider the case $\eta + \delta < \alpha$ (the case $\eta + \delta > \alpha$ follows from parallel arguments, and hence, omitted). From Proposition 2, if the bidder pledges ϕ_1^{**} then $s(\phi_1^{**}) > 0$ implies that shareholders tender with probability $\gamma^{**} \in [0, 1)$, and the bidder's payoff is (writing $\Delta^{**} = \Delta(\gamma^{**})$ and $q^{**} = q(\gamma^{**})$)

$$N\left[\gamma^{**}\Delta^{**}s(\phi_1^{**}) + \gamma^{**}(q^{**} + \Delta^{**})(\eta + \delta - \alpha)\phi_1^{**}\right].$$

First note that there is a $\phi_1^* < \phi_1^{**}$ yielding a higher payoff for the bidder. If $\gamma^{**} > 0$ this follows by envelope arguments: because $\frac{\partial s(\phi_1)}{\partial \phi_1}|_{\phi_1^{**}} = 0$, one can find a ϕ_1 marginally below ϕ_1^{**} such that, holding the acceptance probability unchanged at γ^{**} (by adjusting the offer p), the bidder's payoff is strictly higher. If instead $\gamma^{**} = 0$ then the bidder's payoff from ϕ_1^{**} is zero; moreover, by (**??**) a necessary condition for this case is $\phi_1^{**} > 0$. If the bidder instead chooses

[27] We assume that ϕ_1^{**} is well-defined, and also that $v_1(\cdot)$ is differentiable at ϕ_1^{**}.

[28] We assume that if ϕ_1' leads to a unique equilibrium where the takeover fails, while ϕ_1'' generates multiple equilibria with at least one yielding strictly positive bidder payoff, then the bidder prefers ϕ_1'' to ϕ_1'.

$\phi_1 < 0$, then either $s(\phi_1) > 0$, (**??**) holds, and the bidder's payoff is strictly positive; or else $s(\phi_1) < 0$, and there is an equilibrium in which the bidder's payoff is $N(\eta + \delta - \alpha)\phi_1 > 0$.

Conversely, consider any pledge $\tilde{\phi}_1 > \phi_1^{**}$. If this pledge yields a zero payoff for the bidder then it is dominated by ϕ_1^* above. Otherwise, let $\tilde{\gamma}, \tilde{\Delta}, \tilde{q}$ be the associated probabilities. Note that regardless of whether $\tilde{\gamma} \in (0,1)$ or $\tilde{\gamma} = 1$, the bidder's payoff is bounded above by

$$\begin{aligned} & N\tilde{\gamma}\tilde{\Delta}s(\tilde{\phi}_1) + N\tilde{\gamma}\left(\tilde{q} + \tilde{\Delta}\right)(\eta + \delta - \alpha)\tilde{\phi}_1 \\ < \;& N\tilde{\gamma}\tilde{\Delta}s(\phi_1^{**}) + N\tilde{\gamma}\left(\tilde{q} + \tilde{\Delta}\right)(\eta + \delta - \alpha)\phi_1^{**} \\ \leq \;& N\gamma^{**}\Delta^{**}s(\phi_1^{**}) + N\gamma^{**}\left(q^{**} + \Delta^{**}\right)(\eta + \delta - \alpha)\phi_1^{**}, \end{aligned}$$

so that $\tilde{\phi}_1$ is dominated by ϕ_1^{**}, which is in turn dominated by ϕ_1^*. ■

D Equity offers

This Appendix we analyze equity offers. An equity offer involves the bidder issuing and exchanging $e > 0$ new for each share tendered by the target's shareholders, where e denotes the exchange ratio. We assume the bidding firm has $N_B > 0$ outstanding shares, asset value of $V_B > 0$, and generates externalities denoted by Φ_B. To isolate the core economic mechanisms, we set $\eta = 0$, abstracting from how target shareholders internalize the bidder's externalities absent a takeover. Under this assumption, shareholders internalize externalities in proportion to their ownership stakes.[29] Given free disposal, limited liability, and pure warm-glow preferences, we assume without loss of generality that: $v_B + \alpha\phi_B \geq 0$ and $v_1 + \alpha\phi_1 \geq 0$. We now state and prove the following result.

Proposition 5. *Suppose $\eta = 0$.*

(*a*) *If $\alpha = \delta$ then, the bidder is indifferent between the optimal cash and equity offer.*

(*b*) *Suppose $s > 0$ and $\delta - \alpha < 0$ ($\delta - \alpha > 0$). If $\Phi_1 < 0 = \Phi_B$ or $\Phi_B < -|\Phi_1|$ then the bidder's optimally uses cash (equity) offers, and if $\Phi_1 > 0 = \Phi_B$ or $\Phi_B > |\Phi_1|$ then the bidder's optimally uses equity (cash).*

Proof. Let $v_B \equiv \frac{V_B}{N_B}$ and $v_B \equiv \frac{\Phi_B}{N_B}$. Also, let $\Gamma_{j,N}(\gamma) = \binom{N}{j}\gamma^j(1-\gamma)^{N-j}$. To ease the exposition, we omit γ whenever possible. Note that

$$\Gamma_{j,N} = \gamma\Gamma_{j-1,N-1} + (1-\gamma)\Gamma_{j,N-1}.$$

[29] A successful tender offer does not automatically result in a full merger of the two firms. In such cases, we assume that a share of the bidding firm—which now holds a controlling stake in the target—reflects the target's externalities in proportion to the bidding firm's ownership share in the target.

Given exchange offer e, a shareholder's expected payoff from retaining is

$$\begin{aligned}
&\sum_{j=0}^{K-1}\Gamma_{j,N-1}\left(v_0+\alpha\phi_0\right)+\sum_{j=K}^{N-1}\Gamma_{j,N-1}\left(v_1+\alpha\phi_1\right)\\
=\;&\sum_{j=0}^{K-2}\Gamma_{j,N-1}\left(v_0+\alpha\phi_0\right)+\sum_{j=K-1}^{N-1}\Gamma_{j,N-1}\left(v_1+\alpha\phi_1\right)-\Delta s,
\end{aligned}$$

where $\Delta=\Gamma_{K-1,N-1}\left(\gamma\right)$. The expected payoff from tendering is

$$\sum_{j=0}^{K-2}\Gamma_{j,N-1}\left(v_0+\alpha\phi_0\right)+\sum_{j=K-1}^{N-1}\Gamma_{j,N-1}e\left(\frac{N_B\left(v_B+\alpha\phi_B\right)+\left(j+1\right)\left(v_1+\alpha\phi_1\right)}{N_B+e\left(j+1\right)}\right).$$

Hence, the net benefit from tendering is

$$\begin{aligned}
\tau_{equity}\left(\gamma;e\right) &= \Delta s+\sum_{j=K-1}^{N-1}\Gamma_{j,N-1}\left(e\frac{N_B\left(v_B+\alpha\phi_B\right)+\left(j+1\right)\left(v_1+\alpha\phi_1\right)}{N_B+e\left(j+1\right)}-\left(v_1+\alpha\phi_1\right)\right)\\
&= \Delta s+\sum_{j=K-1}^{N-1}\Gamma_{j,N-1}\left(N_B\frac{ev_B-v_1}{N_B+e\left(j+1\right)}\right)+\alpha\sum_{j=K-1}^{N-1}\Gamma_{j,N-1}\left(N_B\frac{e\phi_B-\phi_1}{N_B+e\left(j+1\right)}\right)\\
&= \Delta s+\sum_{j=K-1}^{N-1}\Gamma_{j,N-1}\varsigma\left(j,e\right)
\end{aligned}$$

where

$$\varsigma\left(j,e\right)=N_B\frac{e-\frac{v_1+\alpha\phi_1}{v_B+\alpha\phi_B}}{N_B+e\left(j+1\right)}\left(v_B+\alpha\phi_B\right).$$

Notice $v_B+\alpha\phi_B\geq 0$ and $v_1+\alpha\phi_1\geq 0$ imply $\tau_{equity}\left(\gamma;e\right)$ is increasing in e. Also,

$$\begin{aligned}
\tau_{equity}\left(0;e\right) &= 0\\
\tau_{equity}\left(1;e\right) &= \varsigma\left(N-1,e\right)=\frac{N_B\left(v_B+\alpha\phi_B\right)}{N_B+eN}\left[e-\frac{v_1+\alpha\phi_1}{v_B+\alpha\phi_B}\right].
\end{aligned}$$

Next,

$$\begin{aligned}
\frac{\partial\tau_{equity}\left(\gamma;e\right)}{\partial\gamma} &= \frac{\partial\Delta}{\partial\gamma}s+\sum_{j=K-1}^{N-1}\frac{\partial\Gamma_{j,N-1}}{\partial\gamma}\varsigma\left(j\right)\\
&= \frac{\partial\Delta}{\partial\gamma}\left(s+\varsigma\left(K-1\right)\right)+\sum_{j=K}^{N-1}\frac{\partial\Gamma_{j,N-1}}{\partial\gamma}\varsigma\left(j\right)
\end{aligned}$$

where

$$
\begin{aligned}
& \sum_{j=K}^{N-1} \frac{\partial \Gamma_{j,N-1}}{\partial \gamma} \varsigma(j) \\
= \; & \frac{\partial}{\partial \gamma} \sum_{j=K}^{N-1} \binom{N-1}{j} \gamma^j (1-\gamma)^{N-1-j} \varsigma(j) \\
= \; & \sum_{j=K}^{N-1} \binom{N-1}{j} j \gamma^{j-1} (1-\gamma)^{N-1-j} \varsigma(j) - \sum_{j=K}^{N-1} \binom{N-1}{j} (N-1-j) \gamma^j (1-\gamma)^{N-2-j} \varsigma(j) \\
= \; & (N-1) \sum_{j=K}^{N-1} \binom{N-2}{j-1} \gamma^{j-1} (1-\gamma)^{N-1-j} \varsigma(j) - (N-1) \sum_{j=K}^{N-2} \binom{N-2}{j} \gamma^j (1-\gamma)^{N-2-j} \varsigma(j) \\
= \; & (N-1) \sum_{j=K-1}^{N-2} \binom{N-2}{j} \gamma^j (1-\gamma)^{N-2-j} \varsigma(j+1) - (N-1) \sum_{j=K}^{N-2} \binom{N-2}{j} \gamma^j (1-\gamma)^{N-2-j} \varsigma(j) \\
= \; & (N-1) \binom{N-2}{K-1} \gamma^{K-1} (1-\gamma)^{N-2-(K-1)} \varsigma(K) + (N-1) \sum_{j=K}^{N-2} \binom{N-2}{j} \gamma^j (1-\gamma)^{N-2-j} \left[\varsigma(j+1) - \varsigma(j)\right] \\
= \; & \frac{N-K}{1-\gamma} \Delta \varsigma(K) + (N-1) \sum_{j=K}^{N-2} \binom{N-2}{j} \gamma^j (1-\gamma)^{N-2-j} \left[\varsigma(j+1) - \varsigma(j)\right]
\end{aligned}
$$

where

$$
\varsigma(j+1) - \varsigma(j) = -\frac{e}{N_B + e(j+1)} \frac{e - \frac{v_1 + \alpha\phi_1}{v_B + \alpha\phi_B}}{N_B + ej}
$$

Thus,

$$
\begin{aligned}
\frac{\partial \tau_{equity}(\gamma; e)}{\partial \gamma} &= \frac{\partial \Delta}{\partial \gamma} \left(s + \varsigma(K-1)\right) + \frac{N-K}{1-\gamma} \Delta \varsigma(K) \\
&\quad + (N-1) \sum_{j=K}^{N-2} \binom{N-2}{j} \gamma^j (1-\gamma)^{N-2-j} \left[\varsigma(j+1) - \varsigma(j)\right] \\
&= \left[\begin{array}{c} \frac{K-1}{\gamma} \left(s + \varsigma(K-1)\right) + \frac{N-K}{1-\gamma} \left(\varsigma(K) - \varsigma(K-1) - s\right) \\ + (N-1) \sum_{j=K}^{N-2} \frac{\Gamma_{j,N-2}}{\Delta} \left[\varsigma(j+1) - \varsigma(j)\right] \end{array} \right] \Delta
\end{aligned}
$$

Notice that $\frac{\partial \tau_{equity}(\gamma;e)}{\partial \gamma}|_{\gamma=0} > 0 \Leftrightarrow s > -\varsigma(K-1)$.

- If $e-\frac{v_1+\alpha\phi_1}{v_B+\alpha\phi_B}<0$ then $\varsigma(j)<0$ for all j. If $s\leq-\varsigma(K-1)$ then

$$\begin{aligned}\tau_{equity}(\gamma;e) &= \Delta s+\sum_{j=K-1}^{N-1}\Gamma_{j,N-1}\varsigma(j,e)\\ &= \Delta\left[s+\varsigma(K-1)\right]+\sum_{j=K}^{N-1}\Gamma_{j,N-1}\varsigma(j,e)\\ &\leq \sum_{j=K}^{N-1}\Gamma_{j,N-1}\varsigma(j,e)\\ &< 0,\end{aligned}$$

and hence, $\gamma^*=0$ is the unique equilibrium. Suppose $s>-\varsigma(K-1)$, which implies $\frac{\partial\tau_{equity}(\gamma;e)}{\partial\gamma}|_{\gamma=0}>0$. Notice

$$s>-\varsigma(K-1)\Leftrightarrow e>\frac{\frac{v_1+\alpha\phi_1}{v_B+\alpha\phi_B}-\frac{s}{v_B+\alpha\phi_B}}{1+\frac{s}{v_B+\alpha\phi_B}\frac{K}{N_B}}\in\left(0,\frac{v_1+\alpha\phi_1}{v_B+\alpha\phi_B}\right).$$

Since $\tau_{equity}(0;e)=0>\tau_{equity}(1;e)$, for any $e\in\left(\frac{\frac{v_1+\alpha\phi_1}{v_B+\alpha\phi_B}-\frac{s}{v_B+\alpha\phi_B}}{1+\frac{s}{v_B+\alpha\phi_B}\frac{K}{N_B}},\frac{v_1+\alpha\phi_1}{v_B+\alpha\phi_B}\right)$ there exists $\gamma(e)$ such that $\tau_{equity}(\gamma(e);e)=0$ and $\tau_{equity}(\cdot;e)$ crosses zero form above, i.e., the equilibrium of the subgame with tendering probability $\gamma(e)$ is stable. If there is more than one such tendering probability, let $\gamma(e)$ be the largest. Since $\tau_{equity}(\gamma;e)$ is continuously increasing in e, and since for every $\gamma\in(0,1)$ we have

$$\begin{aligned}\tau_{equity}\left(\gamma;\frac{\frac{v_1+\alpha\phi_1}{v_B+\alpha\phi_B}-\frac{s}{v_B+\alpha\phi_B}}{1+\frac{s}{v_B+\alpha\phi_B}\frac{K}{N_B}}\right) &= \sum_{j=K}^{N-1}\Gamma_{j,N-1}\varsigma(j,e)<0\\ \tau_{equity}\left(\gamma;\frac{v_1+\alpha\phi_1}{v_B+\alpha\phi_B}\right) &= \Delta s>0,\end{aligned}$$

then $\gamma(e)$ is also continuously increasing in $e\in\left(\frac{\frac{v_1+\alpha\phi_1}{v_B+\alpha\phi_B}-\frac{s}{v_B+\alpha\phi_B}}{1+\frac{s}{v_B+\alpha\phi_B}\frac{K}{N_B}},\frac{v_1+\alpha\phi_1}{v_B+\alpha\phi_B}\right)$, spanning $(0,1)$. Hereafter, and since $s>0$, we assume that if multiple stable equilibria exist in these cases, then the equilibrium with the highest tendering probability is selected.

- If $e-\frac{v_1+\alpha\phi_1}{v_B+\alpha\phi_B}>0$ then $\varsigma(j)>0$ and for all j. If $s\geq-\varsigma(K-1)$ then

$$
\begin{aligned}
\tau_{equity}(\gamma;e) &= \Delta s+\sum_{j=K-1}^{N-1}\Gamma_{j,N-1}\varsigma(j,e) \\
&= \Delta\left[s+\varsigma(K-1)\right]+\sum_{j=K}^{N-1}\Gamma_{j,N-1}\varsigma(j,e) \\
&\geq \sum_{j=K}^{N-1}\Gamma_{j,N-1}\varsigma(j,e) \\
&> 0,
\end{aligned}
$$

and hence, $\gamma^*=1$ is the unique equilibrium. If $s<-\varsigma(K-1)$ then $\frac{\partial\tau_{equity}(\gamma;e)}{\partial\gamma}|_{\gamma=0}<0$ and $\gamma^*=\{0,1\}$ are always equilibria of the same game. Notice there might be interior equilibria.

Next, the bidder's expected payoff is

$$
\begin{aligned}
\Pi_{equity}(\gamma;e) &= \gamma\sum_{j=K-1}^{N-1}\Gamma_{j,N-1}\left(N_B\frac{N_Bv_B+(j+1)v_1}{N_B+e(j+1)}-N_Bv_B+\delta\left[N_B\frac{N_B\phi_B+(j+1)\phi_1}{N_B+e(j+1)}-N_B\phi_B\right]\right) \\
&\quad+(1-\gamma)\sum_{j=K}^{N-1}\Gamma_{j,N-1}\left(N_B\frac{N_Bv_B+jv_1}{N_B+ej}-n_Bv_B+\delta\left[N_B\frac{N_B\phi_B+j\phi_1}{N_B+ej}-N_B\phi_B\right]\right) \\
&= \gamma\sum_{j=K-1}^{N-1}\Gamma_{j,N-1}N_B\frac{(j+1)(v_1-ev_B+\delta\phi_1-\delta e\phi_B)}{N_B+e(j+1)} \\
&\quad+(1-\gamma)\sum_{j=K}^{N-1}\Gamma_{j,N-1}N_B\frac{j(v_1-ev_B+\delta\phi_1-\delta e\phi_B)}{N_B+ej} \\
&= \gamma\sum_{j=K-1}^{N-1}\Gamma_{j,N-1}N_B\frac{(j+1)(v_1-ev_B+\delta\phi_1-\delta e\phi_B)}{N_B+e(j+1)} \\
&\quad+(1-\gamma)\sum_{j=K-1}^{N-2}\Gamma_{j+1,N-1}N_B\frac{(j+1)(v_1-ev_B+\delta\phi_1-\delta e\phi_B)}{N_B+e(j+1)} \\
&= \sum_{j=K-1}^{N-1}(j+1)\Gamma_{j+1,N}\frac{N_B(v_1-ev_B)}{N_B+e(j+1)}+\delta\sum_{j=K-1}^{N-1}(j+1)\Gamma_{j+1,N}\frac{N_B(\phi_1-e\phi_B)}{N_B+e(j+1)}.
\end{aligned}
$$

Note that

$$\begin{aligned}(j+1)\Gamma_{j+1,N} &= (j+1)\frac{N!}{(j+1)!\,(N-j-1)!}\gamma^{j+1}(1-\gamma)^{N-j-1}\\ &= N\gamma\frac{(N-1)!}{j!\,(N-1-j)!}\gamma^{j}(1-\gamma)^{N-1-j}\\ &= N\gamma\Gamma_{j,N-1}.\end{aligned}$$

Thus,

$$\Pi_{equity}(\gamma;e) = N\gamma\left(\sum_{j=K-1}^{N-1}\Gamma_{j,N-1}\frac{N_B(v_1-ev_B)}{N_B+e(j+1)} + \delta\sum_{j=K-1}^{N-1}\Gamma_{j,N-1}\frac{N_B(\phi_1-e\phi_B)}{N_B+e(j+1)}\right).$$

Substituting with the definition of τ,

$$\Pi_{equity}(\gamma;e) = N\gamma\left[\Delta s + (\delta-\alpha)\sum_{j=K-1}^{N-1}\Gamma_{j,N-1}\frac{N_B(\phi_1-e\phi_B)}{N_B+e(j+1)} - \tau(\gamma;e)\right].$$

From the baseline model, a cash offer generates the bidder's an expected payoff of

$$\Pi_{cash}(\gamma;p) = N\gamma\left[\Delta s + (\delta-\alpha)\sum_{j=K-1}^{N-1}\Gamma_{j,N-1}\phi_1 - \tau(\gamma;p)\right]$$

where

$$\tau_{cash}(\gamma;p) = \Delta s - \sum_{j=K-1}^{N-1}\Gamma_{j,N-1}(v_1+\alpha\phi_1-p).$$

Notice

$$\begin{aligned}\Pi_{cash}(\gamma;p) &> \Pi_{equity}(\gamma;e) \Leftrightarrow \\ e(\delta-\alpha)\sum_{j=K-1}^{N-1}\Gamma_{j,N-1}\frac{N_B\phi_B+\phi_1(j+1)}{N_B+e(j+1)} &> \tau_{cash}(\gamma;p)-\tau_{equity}(\gamma;e).\end{aligned} \tag{IA3}$$

Next, suppose $\delta-\alpha=0$. We prove that the means of payment is irrelevant. In this case,

$$\begin{aligned}\Pi_{equity}(\gamma;e) &= N\gamma\left[\Delta s - \tau_{equity}(\gamma;e)\right]\\ \Pi_{cash}(\gamma;p) &= N\gamma\left[\Delta s - \tau_{cash}(\gamma;p)\right]\end{aligned}$$

If $\gamma=1$ is optimal under cash (equity) offers then it must be $\tau_{cash}(\gamma;p)=0$ ($\tau_{equity}(\gamma;e)=0$).

Therefore, the optimal cash and equity offer generates exactly the same expected payoff to the bidder for any parameter values.

Suppose $\delta - \alpha < 0$ and $s > 0$ [the case $\delta - \alpha > 0$ is the mirror image, and hence, omitted].

- We prove that if $\Phi_1 < 0 = \Phi_B$ or $\Phi_B < -|\Phi_1|$ then cash offers are optimal. Then for any $\gamma \in [0,1]$ we have

$$\sum_{j=K-1}^{N-1} \Gamma_{j,N-1} \frac{N_B \phi_B + \phi_1 (j+1)}{N_B + e (j+1)} = \sum_{j=K-1}^{N-1} \Gamma_{j,N-1} \frac{\Phi_B + \Phi_1 \frac{j+1}{N}}{N_B + e (j+1)} < 0.$$

  Let $\gamma_e^* \in (0,1)$ be the tendering probability induced by the optimal equity offer e^*. Based on Lemma 1, cash offer $p = \mu(\gamma_e^*)$ induces tendering probability γ_e^*. Since $\tau_{cash}(\gamma_e^*; \mu(\gamma_e^*)) = \tau_{equity}(\gamma_e^*; e^*) = 0$, condition (IA3) implies $\Pi_{cash}(\gamma_e^*; \mu(\gamma_e^*)) > \Pi_{equity}(\gamma_e^*; e = e^*)$, which means that cash-offers are optimal. If $\gamma_e^* = 1$ then it must be $\tau_{equity}(1; e^*) \geq 0$ and $e^* > 0$. Thus,

$$\begin{aligned} \Pi_{equity}(1; e^*) &= N \left[(\delta - \alpha) \frac{N_B (\phi_1 - e^* \phi_B)}{N_B + e^* N} - \tau_{equity}(1; e) \right] \\ &\leq N (\delta - \alpha) \frac{N_B (\phi_1 - e^* \phi_B)}{N_B + e^* N} \\ &< N (\delta - \alpha) \phi_1 \\ &= \Pi_{cash}(1; \mu(1)). \end{aligned}$$

  Notice $\mu(1) = v_1 + \alpha \phi_1$. Thus, a cash offer strictly dominates.

- We prove that if $\Phi_1 > 0 = \Phi_B$ or $\Phi_B > |\Phi_1|$ then equity offers are optimal. Then for any $\gamma \in [0,1]$ we have

$$\sum_{j=K-1}^{N-1} \Gamma_{j,N-1} \frac{N_B \phi_B + \phi_1 (j+1)}{N_B + e (j+1)} = \sum_{j=K-1}^{N-1} \Gamma_{j,N-1} \frac{\Phi_B + \Phi_1 \frac{j+1}{N}}{N_B + e (j+1)} > 0.$$

  Let $\gamma_p^* \in (0,1)$ be the tendering probability induced by the optimal cash offer, p^*. Based on our derivations above, there is an equity offer $e \in \left(\frac{\frac{v_1 + \alpha\phi_1}{v_B + \alpha\phi_B} - \frac{s}{v_B + \alpha\phi_B}}{1 + \frac{s}{v_B + \alpha\phi_B} \frac{K}{N_B}}, \frac{v_1 + \alpha\phi_1}{v_B + \alpha\phi_B} \right)$ that induces the tendering probability γ_p^*. Let that offer be $e(\gamma_p^*)$. Since $\tau_{equity}(\gamma_p^*; p^*) = \tau_{cash}(\gamma_p^*; e(\gamma_p^*)) = 0$, condition (IA3) implies $\Pi_{cash}(\gamma_p^*; p^*) < \Pi_{equity}(\gamma_p^*; e(\gamma_p^*))$, which means that equity offers are optimal. If $\gamma_p^* = 1$ then it must be $\tau_{cash}(1; p^*) \geq 0$ and

$p^* > v_1 + \alpha\phi_1$. Thus,

$$\begin{aligned} \Pi_{cash}(1;p^*) &= N\left[(\delta-\alpha)\phi_1 - \tau_{cash}(\gamma;p^*)\right] \\ &\leq N(\delta-\alpha)\phi_1 \\ &< N(\delta-\alpha)\frac{N_B(\phi_1 - e^*(1)\phi_B)}{N_B + e^*(1)N} \\ &= \Pi_{equity}(1;e^*(1)), \end{aligned}$$

where $e^*(1) = \frac{v_1+\alpha\phi_1}{v_B+\alpha\phi_B}$. Thus, an equity offer strictly dominates.

■

E Leveraged offers

Proposition 6. *Suppose the bidder can make leverage offers where $d \in [0, v_1 - v_0]$ and $v_1 > v_0$.*

(i) Suppose $s > 0$ and $\phi_1 > \phi_0$. There are $0 \leq \xi' < \xi''$ such that if $(\alpha-\eta-\delta)\phi_1 \leq \xi'$ then $\gamma^* > \kappa$ and if $(\alpha-\eta-\delta)\phi_1 \geq \xi''$ then $\gamma^* < \kappa$.

(ii) Suppose $s > 0$ and $\phi_1 < \phi_0$. There is $0 < \xi'$ such that if $(\alpha-\eta-\delta)\phi_1 \leq \xi'$ then the takeover succeeds with a strictly positive probability and if $(\alpha-\eta-\delta)\phi_1 > \xi'$ the takeover always fails. If $(\alpha-\eta-\delta)\phi_1 = 0$, then there is an equilibrium in which the takeover succeeds with probability $\frac{s(0)}{v_1-v_0}$.

(iii) Suppose $s < 0$. There are $\xi' < 0 < \xi''$ such that if $(\alpha-\eta-\delta)\phi_1 \leq \xi'$ then the takeover succeeds with a strictly positive probability, if $\xi' < (\alpha-\eta-\delta)\phi_1 < \xi''$, there exists an equilibrium in which the takeover succeeds with a strictly positive probability, and if $(\alpha-\eta-\delta)\phi_1 \geq \xi''$ the takeover always fails.

Proof of Proposition 6. Let

$$\begin{aligned} s(d) &\equiv s - d \\ \hat{v}_1(d) &\equiv \hat{v}_1 - d \\ \mu(\gamma;d) &= \hat{v}_1(d) - \frac{\Delta}{q+\Delta}s(d). \end{aligned}$$

For a given (p,d), the equilibrium of the tendering subgame is fully characterized by Lemma 1, where v_1 is replaced everywhere by $v_1 - d$.[30] The bidder's expected payoff per representative

[30] In he knife edge case where (p,d) are such that $s(d) = 0$ and $p = \hat{v}_1(d)$ then $\gamma^* = [0,1]$.

shareholder is

$$\gamma\left(q+\Delta\right)\left(v_{1}-p+\delta\phi_{1}\right)+\left(1-\gamma\right)qd. \tag{IA4}$$

The first term is the same as in (13), multiplied by the tendering probability γ. The second term is the leverage effect: If a shareholder retains his share but the takeover nevertheless succeeds, which happens with probability $(1-\gamma)\,q$, the bidder nevertheless makes a profit of d for reasons explained in the main text.

We first characterize the bidder's profit-maximizing behavior conditional on some choice of d; and then optimize over d. There are three cases to consider:

1. If $s(d)>0$, then, from Lemma 1, $p=\mu(\gamma;d)\in(\hat{v}_1(d)-s(d),\hat{v}_1(d))$. The bidder's payoff is N times

$$\begin{aligned}\Pi &= \gamma\left(q+\Delta\right)\left(v_{1}-p+\delta\phi_{1}\right)+d\left(1-\gamma\right)q\\ &= \gamma\left(q+\Delta\right)\left(v_{1}-\mu\left(\gamma;d\right)+\delta\phi_{1}\right)+d\left(1-\gamma\right)q\\ &= \gamma\Delta s\left(0\right)+dq-\gamma\left(q+\Delta\right)\left(\alpha-\eta-\delta\right)\phi_{1}.\end{aligned} \tag{IA5}$$

   If $p=\hat{v}_1(d)$ then $\gamma=1$ and the bidder's payoff is $Nd-N(\alpha-\eta-\delta)\,\phi_1$. Hence the bidder effectively chooses $\gamma\in[0,1]$ to maximize the term above. Notice

$$\begin{aligned}\frac{1}{N}\frac{\partial\Pi\left(\gamma\right)}{\partial\gamma} &= N\Delta\left[\frac{\kappa-\gamma}{1-\gamma}s\left(0\right)+\frac{1-\kappa}{1-\gamma}d-\left(\frac{q}{\Delta N}+\kappa\right)\left(\alpha-\eta-\delta\right)\phi_{1}\right]\\ &= N\Delta\left[\frac{\kappa-\gamma}{1-\gamma}s\left(d\right)+d-\left(\frac{q}{\Delta N}+\kappa\right)\left(\alpha-\eta-\delta\right)\phi_{1}\right]\end{aligned}$$

   and

$$\frac{\partial\pi\left(\gamma\right)}{\partial\gamma}>0\Leftrightarrow\frac{\kappa-\gamma}{1-\gamma}s\left(d\right)>\left(\frac{q}{\Delta}\frac{1}{N}+\kappa\right)\left(\alpha-\eta-\delta\right)\phi_{1}-d.$$

2. If $s(d)<0$, then, from Lemma 1, $\gamma=1$ is an equilibrium if $p>\hat{v}_1(d)$. Moreover, $\gamma=0$ is also an equilibrium if $p<\hat{v}_1(d)-s(d)=v_0+\alpha\phi_0-\eta\phi_1$.

3. Suppose $s(d)=0$. If $p>\hat{v}_1(d)$ then shareholders always accept; while if $p=\hat{v}_1(d)$ then any $\gamma\in[0,1]$ is a tendering probability in the subgame, and bidder's payoff is N times

$$\begin{aligned}&\gamma\left(q+\Delta\right)\left(v_{1}-\hat{v}_{1}\left(d\right)+\delta\phi_{1}\right)+d\left(1-\gamma\right)q\\ =\;&d\left(q+\gamma\Delta\right)+\gamma\left(q+\Delta\right)\left(\delta+\eta-\alpha\right)\phi_{1}.\end{aligned}$$

Next, we analyze the optimal choice of d. We consider three cases. First, suppose $s(0)<0$.

Since $v_1 > v_0$, it must be $\phi_1 < \phi_0$. Regardless of d, bidding

$$p \geq \hat{v}_1(d) - s(d) = v_0 + \alpha\phi_0 - \eta\phi_1$$

results in $\gamma = 1$ and a payoff of N times

$$\begin{aligned} & v_1 - v_0 - \alpha\phi_0 + \eta\phi_1 + \delta\phi_1 \\ = \; & s(0) - (\alpha - \eta - \delta)\phi_1. \end{aligned}$$

Bidding $p = \hat{v}_1(d) + \epsilon$ gives a second equilibrium in which $\gamma = 1$. In that equilibrium the bidder's payoff is $N(d - (\alpha - \eta - \delta)\phi_1)$ and hence the bidder will choose $d = v_1 - v_0$. In that case, $\gamma = 0$ is also an equilibrium. If the $\gamma = 1$ equilibrium is selected with probability β, the expected payoff per share is

$$\beta(v_1 - v_0 - (\alpha - \eta - \delta)\phi_1).$$

Thus,

- If $v_1 - v_0 \leq (\alpha - \eta - \delta)\phi_1$ then the takeover always fails
- If $s(0) < (\alpha - \eta - \delta)\phi_1 \leq v_1 - v_0$ then the bidder chooses $d^* = v_1 - v_0$ and $p = \hat{v}_1(d^*)$ and for any $\beta \in [0,1]$ there is an equilibrium in which the takeover succeeds with probability β.
- If $(\alpha - \eta - \delta)\phi_1 < s(0)$ then the bidder chooses $p \geq \hat{v}_1(d) - s(d)$ if

  $$s(0) - (\alpha - \eta - \delta)\phi_1 > \beta(v_1 - v_0 - (\alpha - \eta - \delta)\phi_1) \Leftrightarrow \frac{s(0) - (\alpha - \eta - \delta)\phi_1}{v_1 - v_0 - (\alpha - \eta - \delta)\phi_1} > \beta$$

  and $d = v_1 - v_0$ and $p = \hat{v}_1(d)$ otherwise. The takeover succeeds with probability of at least $\frac{s(0) - (\alpha - \eta - \delta)\phi_1}{v_1 - v_0 - (\alpha - \eta - \delta)\phi_1}$

Second, suppose $s(0) > 0$ and $\phi_1 > \phi_0$. If $d = v_1 - v_0$ then $s(d) > 0$. The bidder sets $d = v_1 - v_0$ and chooses γ to maximize

$$\gamma\Delta s(0) + q(v_1 - v_0) + \gamma(q + \Delta)(\delta + \eta - \alpha)\phi_1.$$

Notice

$$\frac{\partial\pi(\gamma)}{\partial\gamma} > 0 \Leftrightarrow \frac{\kappa - \gamma}{1 - \gamma}\alpha(\phi_1 - \phi_0) > \left(\frac{q}{\Delta}\frac{1}{N} + \kappa\right)(\alpha - \eta - \delta)\phi_1 - (v_1 - v_0).$$

Notice γ^* declines in $(\alpha - \eta - \delta)\,\phi_1$. There are three subcases:

- If $(\alpha - \eta - \delta)\,\phi_1 \leq 0$ then there exists $\epsilon > 0$ (independent of N) such that $\frac{\partial \pi(\gamma)}{\partial \gamma} > 0$ if $\gamma \leq \kappa + \epsilon$. So the bidder chooses $\gamma^* \in (\kappa + \epsilon, 1)$. The success probability approaches 1 as N grows large.

- Suppose $0 < (\alpha - \eta - \delta)\,\phi_1 < \frac{1}{\kappa}(v_1 - v_0)$. Recall that according to Lemma 3, $\frac{q}{\Delta}$ is strictly increasing in γ (with limits being 0 and ∞). Thus, there exists $\bar{N} > 0$ such that if $N > \bar{N}$ then there exists $\epsilon > 0$ (independent of N) such that $\frac{\partial \pi(\gamma)}{\partial \gamma} > 0$ if $\gamma \leq \kappa + \epsilon$. So the bidder chooses $\gamma^* \in (\kappa + \epsilon, 1)$. The success probability approaches 1 as N grows large.

- If $(\alpha - \eta - \delta)\,\phi_1 \geq \frac{1}{\kappa}(v_1 - v_0)$ then there exists $\epsilon > 0$ (independent of N) such that $\frac{\partial \pi(\gamma)}{\partial \gamma} < 0$ if $\gamma \geq \kappa - \epsilon$. So the bidder chooses $\gamma^* \in [0, \kappa - \epsilon)$ The success probability approaches 0 as N grows large.

Third, Suppose $s(0) > 0$ and $\phi_1 < \phi_0$. If the bidder sets $d = s(0) - \epsilon$ then $s(d) > 0$ and his payoff is N times

$$\max_{\gamma \in [0,1]} (q + \gamma \Delta)\, s(0) - \epsilon q - \gamma (q + \Delta)(\alpha - \eta - \delta)\,\phi_1$$

Notice

$$\frac{\partial \pi(\gamma)}{\partial \gamma} = \Delta N \left[s(0) - \epsilon \frac{1-\kappa}{1-\gamma} - \left(\frac{1}{N}\frac{q}{\Delta} + \kappa \right)(\alpha - \eta - \delta)\,\phi_1 \right].$$

Therefore,

- If $(\alpha - \eta - \delta)\,\phi_1 \leq 0$ then $\gamma^* = 1$ and $\Pi / N = s(0) - (\alpha - \eta - \delta)\,\phi_1$

- If $0 < (\alpha - \eta - \delta)\,\phi_1 < \frac{s(0)}{\kappa}$ then, since according to Lemma 3 $\frac{q}{\Delta}$ is strictly increasing in γ (with limits being 0 and ∞), the optimal γ solves

  $$s(0) - \left(\frac{1}{N}\frac{q}{\Delta} + \kappa \right)(\alpha - \eta - \delta)\,\phi_1 = 0.$$

  In this case, $\gamma^* \in (0, 1)$ and $\Pi / N = (q + \gamma^* \Delta)\, s(0) - \gamma^* (q + \Delta)(\alpha - \eta - \delta)\,\phi_1$. Notice γ^* declines in $(\alpha - \eta - \delta)\,\phi_1$. Also, in this case, there is $\hat{\xi} > 0$ such that if $(\alpha - \eta - \delta)\,\phi_1 \in \left(0, \hat{\xi}\right)$ then $\gamma^* > \kappa$.

- If $\frac{s(0)}{\kappa} \leq (\alpha - \eta - \delta)\,\phi_1$ then $\gamma^* = 0$ and $\Pi / N = 0$

By further increasing d to $d = v_1 - v_0$ the bidder moves to a situation in which $s(d) < 0$. Notice, $s(0) < v_1 - v_0$, thus, the analysis from first case, where $s(0) < 0$, applies, including the three sub cases. Combined,

- If $(\alpha - \eta - \delta)\,\phi_1 < \max\left\{\frac{s(0)}{\kappa}, v_1 - v_0\right\}$ then the takeover succeeds with a strictly positive probability. Notice that if $(\alpha - \eta - \delta)\,\phi_1 = 0$ then the bidder chooses $d = v_1 - v_0$ the there is an equilibrium in which the success probability is $\frac{s(0)}{v_1 - v_0}$.
- If $\max\left\{\frac{s(0)}{\kappa}, v_1 - v_0\right\} < (\alpha - \eta - \delta)\,\phi_1$ then the takeover always fails.

■

F Legal protections for minority shareholders

Proposition 7. *Suppose $\delta + \eta = \alpha$ and $s > 0$. If the threat of post-takeover litigation is binding, then, $\gamma^* < \kappa$ and $\Lambda^* \to 0$ as $N \to \infty$.*

Proof. Let be ψ a variable that indicates if upon successful litigation the non-tendering shareholders sell their share ($\psi = 1$) or retain it ($\psi = 0$). Suppose litigation is successful with probability σ. The threat of post-takeover litigation is binding,

$$\begin{aligned} v_0 + \eta\phi_1 &> v_1 + \alpha\phi_1 \Leftrightarrow \\ v_0 &> v_1^* \equiv v_1 + \psi\,(\alpha - \eta)\,\phi_1. \end{aligned}$$

Given offer p, the benefit of tendering is

$$\begin{aligned} \hat{\tau}(\gamma; p) &= (p + \eta\phi_1 - v_0 - \alpha\phi_0)\,(q + \Delta) - (v_1 + \alpha\phi_1 + \sigma\,(v_0 + \psi\eta\phi_1 - v_1 - \psi\alpha\phi_1) - (v_0 + \alpha\phi_0))\,q \\ &= \tau(\gamma; p) - \sigma\,(v_0 - v_1 - \psi\,(\alpha - \eta)\,\phi_1)\,q \\ &= \Delta s - (q + \Delta)\,(\hat{v}_1 - p) - \sigma q\,(v_0 - v_1^*) \end{aligned}$$

Notice

$$\begin{aligned} \tau(0; p) &= 0 \\ \tau(1; p) &= p - \hat{v}_1 - \sigma\,(v_0 - v_1^*) \end{aligned}$$

and

$$\frac{\partial \tau}{\partial \gamma} = \left[(p - \hat{v}_1 + s)\,\frac{K-1}{\gamma} - (s + \sigma\,(v_0 - v_1^*))\,\frac{N-K}{1-\gamma}\right]\Delta$$

Thus,

$$\frac{\partial\tau}{\partial\gamma} > 0 \Leftrightarrow (p - (\hat{v}_1 - s)) \frac{K-1}{N-K} > \frac{\gamma}{1-\gamma} (s + \sigma (v_0 - v_1^*)) .$$

Thus, the shape of τ is determined by the following four cases:

(i) τ is increasing then decreasing if $p > \hat{v}_1 - s$ and $s > \sigma (v_1^* - v_0)$

(ii) τ is monotonically increasing if $p \geq \hat{v}_1 - s$ and $s < \sigma (v_1^* - v_0)$

(iii) τ is decreasing then increasing if $p < \hat{v}_1 - s$ and $s < \sigma (v_1^* - v_0)$

(iv) τ is monotonically decreasing if $p \leq \hat{v}_1 - s$ and $s > \sigma (v_1^* - v_0)$.

Following the same steps as in the proof of Lemma 1, one can show that an equilibrium of the tendering subgame always exists. If $s < \sigma (v_1^* - v_0)$ then

$$\gamma^* = \begin{cases} 0 & \text{if } p \leq \hat{v}_1 + \sigma (v_0 - v_1^*) \\ \{0,1\} & \text{if } p \in (\hat{v}_1 + \sigma (v_0 - v_1^*), \hat{v}_1 - s) \\ 1 & \text{if } p \geq \hat{v}_1 - s, \end{cases} \tag{IA6}$$

and if $s > \sigma (v_1^* - v_0)$ then

$$\gamma^* = \begin{cases} 0 & \text{if } p \leq \hat{v}_1 - s \\ \hat{\mu}^{-1}(p) \in (0,1) & \text{if } p \in (\hat{v}_1 - s, \hat{v}_1 + \sigma (v_0 - v_1^*)) \\ 1 & \text{if } p \geq \hat{v}_1 + \sigma (v_0 - v_1^*), \end{cases} \tag{IA7}$$

where

$$\begin{aligned} \hat{\mu}(\gamma) &\equiv \hat{v}_1 - \frac{\Delta}{q+\Delta} s + \sigma \frac{q}{q+\Delta} (v_0 - v_1^*) \\ &= \mu(\gamma) + \sigma \frac{q}{q+\Delta} (v_0 - v_1^*) . \end{aligned}$$

Notice that $\hat{\mu}(\gamma) > \mu(\gamma)$, that is, with legal protections, the bidder must offer more to induce shareholders to tender. The bidder's profits are N times

$$\gamma (q+\Delta) (v_1 + \delta\phi_1 - p) + (1-\gamma) q\sigma (v_1 + \psi\delta\phi_1 - v_0) .$$

Suppose $s > \sigma (v_1^* - v_0)$. Then $p = \hat{\mu}(\gamma)$, and the bidder effectively chooses $\gamma \in [0,1]$.

Substituting $p = \hat{\mu}(\gamma)$, the bidder's profits are N times

$$\begin{aligned}
& \gamma (q+\Delta)(v_1 + \delta\phi_1 - \hat{\mu}(\gamma)) + (1-\gamma) q\sigma (v_1 + \psi\delta\phi_1 - v_0) \\
= \; & \gamma (q+\Delta)\left(v_1 + \delta\phi_1 - \hat{v}_1 + \frac{\Delta}{q+\Delta}s - \sigma\frac{q}{q+\Delta}(v_0 - v_1^*)\right) + (1-\gamma) q\sigma (v_1 + \psi\delta\phi_1 - v_0) \\
= \; & \gamma\Delta s + \gamma (q+\Delta)(\delta + \eta - \alpha)\phi_1 - \sigma q\left[\gamma (v_0 - v_1^*) - (1-\gamma)(v_1 + \psi\delta\phi_1 - v_0)\right] \\
= \; & \gamma\Delta s + \gamma (q+\Delta)(\delta + \eta - \alpha)\phi_1 - \sigma q\left[v_0 - v_1 - \gamma\psi(\alpha - \eta)\phi_1 - (1-\gamma)\psi\delta\phi_1\right]
\end{aligned}$$

Imposing $\delta + \eta = \alpha$, then the bidder chooses γ to maximize

$$\begin{aligned}
& \gamma\Delta s - \sigma q (v_0 - v_1 - \psi\delta\phi_1) \\
= \; & \gamma\Delta s - \sigma q (v_0 - v_1^*)
\end{aligned}$$

Notice the binding litigation constraint implies $v_0 - v_1^* > 0$. If $\sigma(v_1^* - v_0) < s < 0$ then $\gamma^* = 0$, as in the baseline model. If $s > 0$ then derivative of the bidder's profit with respect to γ is Δ times

$$N\left[\frac{\kappa - \gamma}{1-\gamma}s - \frac{1-\kappa}{1-\gamma}\sigma(v_0 - v_1^*)\right],$$

and thus

$$\gamma^* = \max\left\{\kappa - (1-\kappa)\sigma\frac{v_0 - v_1^*}{s}, 0\right\} < \kappa.$$

Notice that γ^* is invariant to N, and since $\gamma^* < \kappa$, as $N \to \infty$, the probability of the takeover converges to zero. ■

G Social responsibility as a takeover defense

Suppose the incumbent selects externalities ϕ_0 prior to any bidder offer, with associated firm value under incumbent control being $v_0(\phi_0)$. That is, different externality choices correspond to varying firm valuations, thereby capturing potential trade-offs between social externalities and pecuniary value. Let $\phi_0^{**} \equiv \arg\max_{\phi_0} v_0(\phi_0) + \alpha\phi_0$ denote the externality level that maximizes social value under the incumbent's control.[31] We assume $s(\phi_0^{**}) > 0$, ensuring the takeover remains socially efficient even when the incumbent chooses socially optimal externalities.[32] This assumption focuses attention on cases where takeovers succeed with positive probability, allowing us to examine how the incumbent's externality choice ϕ_0 influences that probability.

[31] We assume that ϕ_0^{**} is well-defined, and also that $v_0(\cdot)$ is differentiable at ϕ_0^{**}.

[32] The incumbent's choice affects private and social takeover gains without directly influencing post-takeover value or externalities.

Proposition 8. *Suppose $s(\phi_0^{**}) > 0$. Then,*

(i) If $(\alpha - \eta - \delta)\phi_1 < 0$, then an entrenched incumbent minimizes $v_0(\phi_0) + \alpha\phi_0$ while a shareholder-oriented incumbent chooses ϕ_0^{**}.

(ii) If $(\alpha - \eta - \delta)\phi_1 = 0$, then an entrenched incumbent is indifferent while a shareholder-oriented incumbent chooses ϕ_0^{**}.

(iii) If $(\alpha - \eta - \delta)\phi_1 > 0$, then an entrenched incumbent chooses ϕ_0^{**} while a shareholder-oriented incumbent deviates from ϕ_0^{**}.

Proof of Proposition 8. Because, in equilibrium, shareholders are indifferent between tendering and retaining their shares, a shareholder-oriented incumbent maximizes

$$W = \begin{cases} (1-q)(v_0(\phi_0) + \alpha\phi_0) + q(v_1 + \alpha\phi_1) & \text{if } \gamma \in [0,1) \\ p + \eta\phi_1 & \text{if } \gamma = 1. \end{cases} \tag{IA8}$$

An entrenched incumbent minimizes γ.

The proof builds on Proposition 2 and its proof. Since $s > 0$ for all ϕ_0, part (ii) of Proposition 2 applies. Recall that the bidder effectively selects γ to maximize $\pi(\gamma)$. From (IA20),

$$\frac{1}{N}\frac{\partial \pi(\gamma)}{\partial \gamma} = -(q + K\Delta)(\alpha - \eta - \delta)\phi_1 + N\frac{\kappa - \gamma}{1-\gamma}\Delta s. \tag{IA9}$$

There are three cases. First, if $(\alpha - \eta - \delta)\phi_1 = 0$ then $\gamma = \kappa$ and γ is independent of $v_0(\phi_0) + \alpha\phi_0$. Therefore, the entrenched incumbent is indifferent and the shareholder-focused incumbent chooses ϕ_0^{**}.

Second, if $(\alpha - \eta - \delta)\phi_1 < 0$ then $\gamma > \kappa$ and γ is increasing in $v_0(\phi_0) + \alpha\phi_0$. Therefore, the entrenched incumbent chooses $\arg\min_{\phi_0} v_0(\phi_0) + \alpha\phi_0$. Notice that the derivative of W with respect to $v_0(\phi_0) + \alpha\phi_0$ is $1 - q + q's(\phi_0) > 0$. Since $s > 0$ for all ϕ_0, $\phi_0^{**} = \arg\max_{\phi_0} W$, and the shareholder-focused incumbent chooses ϕ_0^{**}.

Last, if $(\alpha - \eta - \delta)\phi_1 > 0$ then $\gamma < \kappa$ and γ is decreasing in $v_0(\phi_0) + \alpha\phi_0$. Therefore, the entrenched incumbent chooses $\phi_0^{**} = \arg\max_{\phi_0} v_0(\phi_0) + \alpha\phi_0$. ■

H Freeze-out mergers

In practice, freeze-out mergers allow bidders who acquire a controlling stake in the target firm to force the sale of all remaining non-tendered shares at the original offer price p, effectively eliminating the ability of target shareholders to retain minority stakes and benefit from the full post-takeover value appreciation, v_1. Importantly, however, freeze-out mergers cannot exclude non-tendering shareholders from the externalities generated by the takeover. Does this mean that freeze-out mergers change the conclusions of our analysis? Perhaps surprisingly, the answer is no, at least qualitatively.

Specifically, and as in Mueller and Panunzi (2004), suppose that following a successful takeover, the bidder is able to execute a successful freeze-out merger with (exogenous) probability $\theta \in [0, 1)$; our baseline model is the special case $\theta = 0$.[33] Following the discussion in Amihud et al (2004) and Mueller and Panunzi (2004), we assume that legal restrictions ensure that minority shareholders receive the original offer p in a freeze-out.[34]

Proposition 9. *If $s < 0$ then the equilibrium is invariant to the freeze-out probability θ. If $s > 0$, then:*

(i) If $(\alpha - \eta - \delta)\,\phi_1 < (>)\, 0$ then $\Lambda^* \to 1$ ($\Lambda^* \to 0$) as $N \to \infty$.

(ii) If $(\alpha - \eta - \delta)\,\phi_1 = 0$ and $\kappa \geq 0.5$, then $\gamma^* > \kappa$, it is strictly increasing in θ, and $\gamma^* \to \kappa$ as $N \to \infty$.

Proposition 9 establishes that freeze-outs do not affect the success rate of socially inefficient takeovers, or of any takeovers in the limit when social preferences are imbalanced. The reason is that, in these cases, shareholders either reject the offer with certainty ($\gamma = 0$) or accept it with certainty ($\gamma = 1$). In both scenarios, no minority shareholders remain after the transaction, rendering freeze-outs irrelevant.

However, when social preferences are balanced, the possibility of freeze-outs increases the success rate of socially efficient takeovers. To understand this result, note that with freeze-outs, the contribution of each shareholder (by tendering) remains the same, Δs, but the cost of contribution is effectively lower: If a shareholder retains his share, then with probability $q\theta$ both the takeover and the freeze-out succeed, and in those cases, the shareholder can no longer hold onto his share; he is forced to tender.[35] Since freeze-outs ameliorate non-excludability, they increase the bidder's probability of acquiring a share for a given offer, or alternatively,

[33] See Dalkır at al. (2019) for the analysis of tender offers without externalities in which freeze-out mergers succeed if and only if the number of tendered shares is at least $F \in \{K+1, ..., N-1\}$. In this model, the analog of $q\theta$ is $\sum_{j=F}^{N-1} \binom{N-1}{j} \gamma^j (1-\gamma)^{N-1-j}$, which is endogenous.

[34] Dalkır et al. (2019) show that freeze-out mergers do not fully resolve the holdout problem as long as shareholders can be pivotal for the takeover, even if the probability of being pivotal is arbitrarily small. Mueller and Panunzi (2004) also highlight the limitations of freeze-out mergers, noting their vulnerability to legal challenges when shareholders are infinitesimal. Additionally, Bates, Becher, and Lemmon (2006) provide empirical evidence suggesting that minority shareholders retain some bargaining power in freeze-out mergers, further indicating that these mergers are not a complete solution to the holdout problem.

[35] The cost is reduced to $(q + \Delta - q\theta)\,(\hat{v}_1 - p)$.

reduce the offer needed to induce a given tendering probability γ. In principle it is possible that the bidder responds by aggressively reducing the bid, so that the equilibrium success probability falls. But Proposition 9 establishes that this doesn't happen, and that the success probability rises; a rough intuition is that the value of freeze-outs rises in the probability of takeover success, which raises the value that the bidder attaches to takeover success.

Proof of Proposition 9. With freeze-outs, a shareholder's expected utility from retaining a share is

$$v_0 + \alpha\phi_0 + q(1-\theta)(v_1 + \alpha\phi_1 - v_0 - \alpha\phi_0) + q\theta(p + \eta\phi_1 - v_0 - \alpha\phi_0). \tag{IA10}$$

That is: with probability $q(1-\theta)$ the takeover succeeds but the freeze-out fails, and a retaining-shareholder's payoff is exactly as in the non-freeze-out case; but with probability $q\theta$ the takeover succeeds and the freeze-out succeeds, and in this case a retaining shareholder receives p for the share and values the externalities associated with the takeover at $\eta\phi_1$.

A shareholder's expected utility from tendering does not depend on the success of the freeze-out, and so is the same as in the no-freeze-out baseline, see (6). Hence the marginal benefit of tendering is

$$\tau_\theta(\gamma; p) \equiv \Delta s - (q(1-\theta) + \Delta)(\hat{v}_1 - p), \tag{IA11}$$

which takes the same form as its no-freeze-out analogue (7), with the sole difference being that the probability q of holding out and benefiting from a takeover is reduced to $(1-\theta)q$.

Next, the bidder's expected payoff per shareholder is

$$(\gamma(q+\Delta) + (1-\gamma)\theta q)(v_1 - p + \delta\phi_1). \tag{IA12}$$

That is: Fix a representative shareholder. With probability γ the shareholder tenders; conditional on this, the takeover succeeds with probability $q + \Delta$, and the bidder gains $v_1 - p + \delta\phi_1$ from the tendered share. With probability $1-\gamma$ the shareholder retains the share; conditional on this, the takeover succeeds with probability q; and conditional on this, a freeze-out succeeds with probability θ, and the bidder again gains $v_1 - p + \delta\phi_1$ from the share acquired in the freeze-out.

It is straightforward to replace τ with τ_θ in the proof of Lemma 1, where $\theta \in [0,1)$. If $s < 0$, the equilibrium of the tendering subgame exactly coincides with the no-freeze-out baseline ($\theta = 0$). Moreover, in this case the only possible equilibria are $\gamma = 0$ and $\gamma = 1$, and freeze-outs don't affect the bidder's profits in these cases. Consequently, in this case both the bidder's equilibrium offer and shareholders' equilibrium response coincide with the no-freeze-out baseline.

The remainder of the proof deals with the case of $s > 0$. The bidder's profit $\pi(\gamma)$ in a mixed-strategy equilibrium is N times

$$\begin{aligned}
& (\gamma(q+\Delta)+(1-\gamma)q\theta)(v_1-\mu_\theta(\gamma)+\delta\phi_1) \\
= \; & (\gamma(q(1-\theta)+\Delta)+q\theta)\left(v_1-\hat{v}_1+\frac{\Delta}{q(1-\theta)+\Delta}s+\delta\phi_1\right) \\
= \; & (\gamma(q(1-\theta)+\Delta)+q\theta)\left(\frac{\Delta}{q(1-\theta)+\Delta}s+(\delta+\eta-\alpha)\phi_1\right) \\
= \; & \left(\Delta\gamma+\theta\frac{\Delta q}{q(1-\theta)+\Delta}\right)s+(\gamma(q(1-\theta)+\Delta)+q\theta)(\delta+\eta-\alpha)\phi_1. \qquad \text{(IA13)}
\end{aligned}$$

Moreover, the minimum offer that generates $\gamma = 1$ as an equilibrium for the tendering subgame is $p = \hat{v}_1$, which gives profits of $N(\delta+\eta-\alpha)\phi_1$, coinciding with the expression above as $\gamma \to 1$. Consequently the bidder effectively chooses $\gamma \in [0,1]$ to maximize (IA13).

Suppose $\delta + \eta \neq \alpha$. We show that large N the outcome is same as for non-freezeout case. The bidder's profit in (IA13) can be rewritten as

$$(\gamma(q+\Delta)+q\theta(1-\gamma))\left[\frac{\Delta}{q(1-\theta)+\Delta}S+(\delta+\eta-\alpha)\Phi_1\right]$$

Suppose $(\delta+\eta-\alpha)\Phi_1 < 0$. Notice $\Delta \to 0$ regardless of γ^*. If on the contrary $\lim_{N\to\infty} q > 0$, then it must be $\lim_{N\to\infty}\gamma^* > 0$. Bidder's payoff converges to $(\delta+\eta-\alpha)\Phi_1 \times \lim_{N\to\infty}(\gamma q + q\theta(1-\gamma)) < 0$, a contradiction. Therefore, it must be $\Lambda^* \to 0$.

Suppose $(\delta+\eta-\alpha)\Phi_1 > 0$. The bidder's profit from $\gamma = 1$ is $(\delta+\eta-\alpha)\Phi_1 > 0$. If on the contrary $\lim_{N\to\infty} q < 1$ then

$$\begin{aligned}
& (\delta+\eta-\alpha)\Phi_1 \lim_{N\to\infty}(\gamma q + q\theta(1-\gamma)) \\
< \; & (\delta+\eta-\alpha)\Phi_1 \lim_{N\to\infty}(\gamma+\theta(1-\gamma)) \\
\leq \; & (\delta+\eta-\alpha)\Phi_1,
\end{aligned}$$

a contradiction. Therefore, it must be $\Lambda^* \to 1$.

Suppose $\delta + \eta = \alpha$. From (IA13), the bidder's problem reduces to choosing γ to maximize

$$\Delta\gamma+\theta\frac{\Delta q}{q(1-\theta)+\Delta}. \qquad \text{(IA14)}$$

The term $\Delta\gamma$ is single-peaked and obtains its maximum at $\gamma = \frac{K}{N}$. Differentiating the second term in (IA14) gives

$$\begin{aligned}
\frac{\partial}{\partial \gamma}\left(\frac{\Delta q}{q(1-\theta)+\Delta}\right) &= \frac{((1-\theta)q+\Delta)\left(q\frac{\partial \Delta}{\partial \gamma}+\Delta\frac{\partial q}{\partial \gamma}\right)-\Delta q\left((1-\theta)\frac{\partial q}{\partial \gamma}+\frac{\partial \Delta}{\partial \gamma}\right)}{((1-\theta)q+\Delta)^2} \\
&= \frac{(1-\theta)q^2\frac{\partial \Delta}{\partial \gamma}+(1-\theta)q\Delta\frac{\partial q}{\partial \gamma}+\Delta q\frac{\partial \Delta}{\partial \gamma}+\Delta^2\frac{\partial q}{\partial \gamma}-\Delta q(1-\theta)\frac{\partial q}{\partial \gamma}-\Delta q\frac{\partial \Delta}{\partial \gamma}}{((1-\theta)q+\Delta)^2} \\
&= \frac{(1-\theta)q^2\frac{\partial \Delta}{\partial \gamma}+\Delta^2\frac{\partial q}{\partial \gamma}}{((1-\theta)q+\Delta)^2}. \qquad \text{(IA15)}
\end{aligned}$$

To establish that the bidder selects $\gamma > \frac{K}{N}$ we show that (IA15) is strictly positive for all $\theta > 0$ and $\gamma \leq \frac{K}{N}$. Note that $\frac{\partial \Delta}{\partial \gamma} > 0$ if and only $\gamma < \frac{K-1}{N-1}$,[36] while $\frac{\partial q}{\partial \gamma} > 0$ for all $\gamma \in (0,1)$. Hence (IA15) is strictly positive for all $\gamma \leq \frac{K-1}{N-1}$. So it remains to show that (IA15) is strictly positive for $\gamma \in \left(\frac{K-1}{N-1}, \frac{K}{N}\right]$; and it suffices to establish this statement at $\theta = 0$.

Expanding (using Lemma 2), we must show

$$\left(\frac{K-1}{\gamma}-\frac{N-K}{1-\gamma}\right)\Delta q^2+\Delta^2\frac{N-K}{1-\gamma}\Delta > 0 \text{ for } \gamma \in \left(\frac{K-1}{N-1}, \frac{K}{N}\right],$$

or equivalently,

$$\frac{1-\gamma}{\gamma}(K-1)-(N-K)+\left(\frac{\Delta}{q}\right)^2(N-K) > 0 \text{ for } \gamma \in \left(\frac{K-1}{N-1}, \frac{K}{N}\right].$$

From Lemma 3, the ratio $\frac{\Delta}{q}$ is decreasing in γ, and so it suffices to establish the inequality at $\gamma = \frac{K}{N}$. By straightforward manipulation, this is equivalent to

$$\sqrt{K}\Delta > q \text{ at } \gamma = \frac{K}{N}. \qquad \text{(IA16)}$$

We establish inequality (IA16) in two steps. First, we fix $K \geq 2$, and establish the inequality for $N = 2K$. Second, we show that if (IA16) holds for $N = 2K$ then it also holds for any $N < 2K$.

For the first step, consider $N = 2K$. Note that there are K binomial terms from $\binom{N-1}{0}$ to $\binom{N-1}{K-1}$, and likewise $N-K = K$ binomial terms from $\binom{N-1}{K}$ to $\binom{N-1}{N-1}$. So by symmetry, it

[36] $\frac{\partial \Delta}{\partial \gamma} > 0$ is equivalent to $\frac{K-1}{\gamma} - \frac{N-K}{1-\gamma} > 0$, i.e., to $(1-\gamma)K - (1-\gamma) - \gamma N + \gamma K > 0$, and hence to $K - 1 > \gamma(N-1)$.

follows that if $\gamma = \frac{K}{N} = \frac{1}{2}$ then $q = \frac{1}{2}$. Hence we need to show

$$\sqrt{K}\binom{2K-1}{K-1}\left(\frac{1}{2}\right)^{2K-1} > \frac{1}{2}.$$

We establish this by induction in K. At $K = 1$ the LHS evaluates to $\frac{1}{2}$. Hence it suffices to show that for any $K \geq 1$,

$$\sqrt{K+1}\binom{2(K+1)-1}{(K+1)-1}\left(\frac{1}{2}\right)^{2(K+1)-1} > \sqrt{K}\binom{2K-1}{K-1}\left(\frac{1}{2}\right)^{2K-1},$$

i.e.,

$$\sqrt{\frac{K+1}{K}}\left(\frac{1}{2}\right)^2 > \frac{(2K-1)!}{(2K+1)!}\frac{K!}{(K-1)!}\frac{(K+1)!}{K!} = \frac{(K+1)\,K}{(2K+1)\,2K},$$

i.e.,

$$K + \frac{1}{2} > \sqrt{K}\sqrt{K+1},$$

which indeed holds by the concavity of the log function.

For the second step, we show that if (IA16) holds for $N = 2K$ then it also holds for any $N < 2K$. It suffices to show that $\frac{q(\frac{K}{N})}{\Delta(\frac{K}{N})}$ is increasing in N (holding K fixed). Note

$$\frac{q}{\Delta} = \frac{\sum_{j=K}^{N-1}\binom{N-1}{j}\gamma^j(1-\gamma)^{N-1-j}}{\binom{N-1}{K-1}\gamma^{K-1}(1-\gamma)^{N-1-(K-1)}} = \sum_{j=K}^{N-1}\frac{(K-1)!\,(N-K)!}{j!\,(N-1-j)!}\gamma^{j-K+1}(1-\gamma)^{K-1-j}.$$

Defining $\tilde{j} = j - K + 1$ and substituting in $\gamma = \frac{K}{N}$,

$$\frac{q}{\Delta} = \sum_{\tilde{j}=1}^{N-K}\frac{(K-1)!\,(N-K)!}{(\tilde{j}+K-1)!\,\left(N-K-\tilde{j}\right)!}\left(\frac{K}{N-K}\right)^{\tilde{j}}.$$

Expanding,

$$\frac{q}{\Delta} = \sum_{j=1}^{N-K}\frac{(N-K)\cdot\ldots\cdot(N-K-j+1)}{K\cdot\ldots\cdot(j+K-1)}\left(\frac{K}{N-K}\right)^j = \sum_{j=1}^{N-K}\frac{1\cdot\left(1-\frac{1}{N-K}\right)\cdot\ldots\cdot\left(1-\frac{j-1}{N-K}\right)}{1\cdot\left(1+\frac{1}{K}\right)\cdot\ldots\cdot\left(1+\frac{j-1}{K}\right)},$$

which is indeed increasing in N, thereby establishing (IA16).

Finally, we establish that the bidder's profit-maximizing choice of γ is strictly increasing in the freeze-out probability θ. Recall that the bidder sets γ to

$$\arg\max_{\gamma\in[0,1]}\left(\Delta\gamma+\theta\frac{\Delta q}{q\left(1-\theta\right)+\Delta}\right). \tag{IA17}$$

Note that both $\gamma=0,1$ give zero bidder profits, and so certainly the bidder's choice of γ is interior. From (IA15) we know that if

$$\frac{\partial}{\partial\gamma}\left(\frac{\Delta q}{q\left(1-\theta\right)+\Delta}\right)\geq 0$$

for some γ and θ, then this inequality holds strictly for any $\tilde{\theta}>\theta$: this follows trivially if $\frac{\partial\Delta}{\partial\gamma}\geq 0$, and follows easily if $\frac{\partial\Delta}{\partial\gamma}<0$. Consequently, (IA17) is strictly increasing in θ over any neighborhood of θ -values in which it is unique. Finally, suppose there is some θ at which both γ_1 and $\gamma_2>\gamma_1$ maximize the bidder's objective (IA14). Let $q_1,\Delta_1,q_2,\Delta_2$ denote q and Δ evaluated at γ_1 and γ_2. Note that

$$\Delta_1\gamma_1+\theta\frac{\Delta_1 q_1}{q_1\left(1-\theta\right)+\Delta_1}=\Delta_2\gamma_2+\theta\frac{\Delta_2 q_2}{q_2\left(1-\theta\right)+\Delta_2}.$$

We know $\gamma_2>\gamma_1>\kappa$ and hence both $\Delta_1>\Delta_2$ and $\Delta_1\gamma_1>\Delta_2\gamma_2$, and hence

$$\frac{\Delta_1 q_1}{q_1\left(1-\theta\right)+\Delta_1}<\frac{\Delta_2 q_2}{q_2\left(1-\theta\right)+\Delta_2}.$$

Note that

$$\frac{\partial}{\partial\theta}\frac{\Delta q}{q\left(1-\theta\right)+\Delta}=\frac{1}{\Delta}\left(\frac{\Delta q}{q\left(1-\theta\right)+\Delta}\right)^2,$$

implying that for $\tilde{\theta}>\theta$

$$\Delta_1\gamma_1+\tilde{\theta}\frac{\Delta_1 q_1}{q_1\left(1-\tilde{\theta}\right)+\Delta_1}<\Delta_2\gamma_2+\tilde{\theta}\frac{\Delta_2 q_2}{q_2\left(1-\tilde{\theta}\right)+\Delta_2}.$$

It again follows that the bidder's profit-maximizing choice γ is increasing in θ.

Next, we show $\gamma^* \to \kappa$. The derivative of the bidder's profit with respect to γ is

$$\begin{aligned}
&\Delta + \gamma \frac{\partial \Delta}{\partial \gamma} + \theta \frac{(1-\theta)\, q^2 \frac{\partial \Delta}{\partial \gamma} + \Delta^2 \frac{\partial q}{\partial \gamma}}{\left((1-\theta)\, q + \Delta\right)^2} \\
= \;& \Delta \left(K - \frac{\gamma}{1-\gamma} (N-K) + \theta \frac{(1-\theta)\, q^2 \left(\frac{K-1}{\gamma} - \frac{N-K}{1-\gamma}\right) + \Delta^2 \frac{N-K}{1-\gamma}}{\left((1-\theta)\, q + \Delta\right)^2} \right) \\
= \;& \frac{N\Delta}{1-\gamma} \left(\kappa - \gamma + \theta \frac{(1-\theta)\, q^2 \left(\frac{1-\gamma}{\gamma}\left(\kappa - \frac{1}{N}\right) - (1-\kappa)\right) + \Delta^2 (1-\kappa)}{\left((1-\theta)\, q + \Delta\right)^2} \right)
\end{aligned}$$

Fix $\gamma > \kappa$, then the term inside the parentheses converges (as $N \to \infty$) to

$$(\kappa - \gamma) \left(1 + \frac{1}{\gamma} \frac{\theta}{1-\theta}\right) < 0$$

Combined with the existing result that $\gamma > \kappa$ for any N, this establishes that $\gamma^* \to \kappa$ as $N \to \infty$. ■

I Consequentialist bidders

In this Appendix we extend the analysis to bidders with consequentialist preferences: in addition to deriving a warm-glow utility of $\delta\phi_1$ per acquired share, the bidder internalizes an externality of $\rho\phi_1$ ($\rho\phi_0$) per non-acquired share if the takeover succeeds (fails), where $\rho \in [0, \delta]$. Proposition 10 below generalizes Proposition 2 and shows that consequentialist preferences ($\rho > 0$) can backfire. Specifically: starting from a case in which preferences are balanced ($\eta + \delta = \alpha$, for example, because shareholders are consequentialist and the bidder is purely profit-orientated), the introduction of consequentialist preferences for the bidder reduces the likelihood of socially efficient acquisitions that worsen externalities (i.e., $s > 0$ but $\phi_1 < \phi_0$).

The intuition for this result starts from the generalized holdout property (18): because of free-riding by target shareholders, the bidder captures only a small fraction of the surplus (s). However, under consequentialist preferences the bidder fully internalizes the negative externalities associated with the takeover. This asymmetry leads the bidder to place excessive weight on these externalities in its bidding strategy, which can distort the takeover decision and ultimately block an otherwise socially beneficial acquisition. Paradoxically, this implies that a purely profit-maximizing bidder (i.e., ones with $\delta = \rho = 0$) may achieve higher social efficiency. This finding provides a normative rationale for a *narrowed Friedman doctrine* for acquiring firms, particularly when target shareholders already exhibit social responsibility.

Proposition 10. *Suppose the bidder has consequentialist preferences ρ.*

(*i*) *Suppose $s < 0$. If $s \leq (\alpha - \eta - \delta + \rho)\,\phi_1 - \rho\,(\phi_1 - \phi_0)$, then $\gamma^* = 0$ is an equilibrium. If $(\alpha + \rho - \delta - \eta)\,\phi_1 - \rho\,(\phi_1 - \phi_0) < 0$, then $\gamma^* = 1$ is an equilibrium. No other equilibrium exists.*

(*ii*) *Suppose $s > 0$ and $\rho\,(\phi_1 - \phi_0) = 0$. In the unique equilibrium:*

- (*a*) *If $(\alpha - \eta - \delta + \rho)\,\phi_1 < 0$ then $\gamma^* > \kappa$, and $\Lambda^* \to 1$ as $N \to \infty$.*
- (*b*) *If $(\alpha - \eta - \delta + \rho)\,\phi_1 = 0$ then $\gamma^* = \kappa$, and the takeover outcome is uncertain as $N \to \infty$.*
- (*c*) *If $(\alpha - \eta - \delta + \rho)\,\phi_1 > 0$ then $\gamma^* < \kappa$, and $\Lambda^* \to 0$ as $N \to \infty$.*

(*iii*) *Suppose $s > 0$ and $\rho\,(\phi_1 - \phi_0) > 0$. In the unique equilibrium:*

- (*a*) *If $(\alpha - \eta - \delta + \rho)\,\phi_1 < \frac{\rho}{\kappa}\,(\phi_1 - \phi_0)$ then $\Lambda^* \to 1$ as $N \to \infty$.*
- (*b*) *If $(\alpha - \eta - \delta + \rho)\,\phi_1 \geq \frac{\rho}{\kappa}\,(\phi_1 - \phi_0)$ then $\Lambda^* \to 0$ as $N \to \infty$.*

(*iv*) *Suppose $s > 0$ and $\rho\,(\phi_1 - \phi_0) < 0$. In the unique equilibrium:*

- (*a*) *If $(\alpha - \eta - \delta + \rho)\,\phi_1 \leq \frac{\rho}{\kappa}\,(\phi_1 - \phi_0)$ then $\Lambda^* \to 1$ as $N \to \infty$.*
- (*b*) *If $(\alpha - \eta - \delta + \rho)\,\phi_1 \geq 0$ then $\Lambda^* \to 0$ as $N \to \infty$.*

Proof. In this setup, the bidder's expected payoff is

$$\Pi\,(\gamma; \rho) = N\,[\gamma\,(q + \Delta)\,(v_1 - p + \delta\phi_1) + (1 - \gamma)\,q\rho\phi_1 + (1 - q - \gamma\Delta)\,\rho\phi_0]\,. \tag{IA18}$$

Effectively, the bidder's objective is to maximize

$$\gamma\,(q + \Delta)\,(v_1 - p + (\delta - \rho)\,\phi_1) + (q + \gamma\Delta)\,\rho\,(\phi_1 - \phi_0)\,. \tag{IA19}$$

Compared to baseline model, the bidder's payoff reflects two sources of incremental social benefit: the warm-glow preferences, captured by $\delta - \rho$, and the change in takeover externalities driven by consequentialist preferences, quantified as $(q + \gamma\Delta)\,\rho\,(\phi_1 - \phi_0)$, where $q + \gamma\Delta$ is the probability the takeover succeeds.

Notice that the tendering sub game does not change and thus Lemma 1 applies.

If $s < 0$ then Lemma 1 implies that γ^* is given by (9). From (IA18), $\Pi\,(0) = N\rho\phi_0$ and $\Pi\,(1) = N\,(v_1 - p + \delta\phi_1)$. Hence if $v_1 - \hat{v}_1 + \delta\phi_1 < \rho\phi_0 \Leftrightarrow (\alpha + \rho - \delta - \eta)\,\phi_1 - \rho\,(\phi_1 - \phi_0) > 0$, then the bidder's payoff is strictly smaller than $N\rho\phi_0$ in any equilibrium with $\gamma^* = 1$. In this case, $\gamma = 0$ is the unique equilibrium. Conversely, if $(\alpha + \rho - \delta - \eta)\,\phi_1 - \rho\,(\phi_1 - \phi_0) \leq 0$ then for any $p \in (\hat{v}_1, \hat{v}_1 - s]$ there is an equilibrium in which the bidder offers p and $\gamma^* = 1$. The bid $p = \hat{v}_1 - s$ guarantees both $\gamma^* = 1$ and a payoff higher than $N\rho\phi_0$ for the bidder if $v_1 - (\hat{v}_1 - s) + \delta\phi_1 > \rho\phi_0 \Leftrightarrow s > (\alpha + \rho - \eta - \delta)\,\phi_1 - \rho\,(\phi_1 - \phi_0)$. Hence an equilibrium with $\gamma^* = 0$ exists if and only if $s \leq (\alpha + \rho - \eta - \delta)\,\phi_1 - \rho\,(\phi_1 - \phi_0)$.

Second, if $s > 0$ then Lemma 1 implies that γ^* is given by (11). Offers in $(\hat{v}_1 - s, \hat{v}_1)$ deliver shareholder acceptance probabilities γ satisfying $\mu(\gamma) = p$ and associated bidder's payoff (per share) of

$$\frac{\pi(\gamma)}{N} = \gamma\Delta\,[s + \rho\,(\phi_1 - \phi_0)] + \gamma\,(q + \Delta)\,(\delta - \rho + \eta - \alpha)\,\phi_1 + q\rho\,(\phi_1 - \phi_0) + \rho\phi_0$$

The offer $p = \hat{v}_1$ delivers a shareholder acceptance probability of $\gamma = 1$ and a bidder payoff of $N\,(\delta + \eta - \alpha)\,\phi_1 = \pi(1)$. Recall from Lemma 1 that as p increases over the interval $(\hat{v}_1 - s, \hat{v}_1)$ the shareholder acceptance probability increases continuously from 0 to 1. Hence the bidder effectively picks γ (via choice of offer p) to solve $\max_{\gamma\in[0,1]} \pi(\gamma)$. Rearranging,

$$\begin{aligned}\frac{\pi(\gamma)}{N} &= \gamma\,(q + \Delta)\,[s + \rho\,(\phi_1 - \phi_0) + (\delta - \rho + \eta - \alpha)\,\phi_1] \\ &\quad -\gamma q\,[s + \rho\,(\phi_1 - \phi_0)] + q\rho\,(\phi_1 - \phi_0) + \rho\phi_0\end{aligned}$$

From Lemma 2,

$$\begin{aligned}\frac{\partial\,[\gamma\,(q + \Delta)]}{\partial\gamma} &= q + K\Delta \\ \frac{\partial\,[\gamma q]}{\partial\gamma} &= q + \frac{N - K}{1 - \gamma}\gamma\Delta,\end{aligned}$$

Hence

$$\begin{aligned}\frac{1}{N}\frac{\partial\pi(\gamma)}{\partial\gamma} &= (q + K\Delta)\,[s + \rho\,(\phi_1 - \phi_0) + (\delta - \rho + \eta - \alpha)\,\phi_1] \\ &\quad -\left(q + \frac{N - K}{1 - \gamma}\gamma\Delta\right)[s + \rho\,(\phi_1 - \phi_0)] + \frac{N - K}{1 - \gamma}\Delta\rho\,(\phi_1 - \phi_0) \\ &= \frac{\kappa - \gamma}{1 - \gamma}N\Delta s + \left(\frac{q}{N\Delta} + \kappa\right)N\Delta\,(\delta - \rho + \eta - \alpha)\,\phi_1 + \Delta N\rho\,(\phi_1 - \phi_0) \qquad \text{(IA20)}\end{aligned}$$

Hence
$$\frac{\partial\pi(\gamma)}{\partial\gamma} > 0 \Leftrightarrow \frac{\kappa - \gamma}{1 - \gamma}s > \left(\frac{q}{N\Delta} + \kappa\right)(\alpha - \eta - \delta + \rho)\,\phi_1 - \rho\,(\phi_1 - \phi_0)\,.$$

Suppose $\rho(\phi_1 - \phi_0) = 0$. There are three subcases:

- Subcase $(\alpha - \eta - \delta + \rho)\phi_1 < 0$: There exists $\epsilon > 0$ (independent of N) such that $\frac{\partial\pi(\gamma)}{\partial\gamma} > 0$ if $\gamma \le \kappa + \epsilon$. So the bidder chooses $\gamma^* \in (\kappa + \epsilon, 1)$. The success probability approaches 1 as N grows large, while $\Delta \to 0$. From Lemma 1, if the bidder offers $p = \hat{v}_1$ then all shareholders tender with probability 1, and so the bidder's payoff is $N(v_1 + \delta - p) = -(\alpha - \eta - \delta)\Phi_1$. This offer is suboptimal, and so $-(\alpha - \eta - \delta)\Phi_1$ is a lower bound for the bidder's payoff. Hence the bidder's payoff approaches $-(\alpha - \eta - \delta)\Phi_1$ as N grows large (which also establishes that $\gamma^* \to 1$).

- Subcase $(\alpha - \eta - \delta + \rho)\phi_1 = 0$: The bidder chooses $\gamma^* = \kappa$. Therefore, $p^* = \mu(\kappa)$. The takeover success probability is bounded away from both 0 and 1. As N grows large the bidder's payoff Π^* approaches $\rho\Phi_0$.

- Subcase $(\alpha - \eta - \delta + \rho)\phi_1 > 0$: There exists $\epsilon > 0$ (independent of N) such that $\frac{\partial\pi(\gamma)}{\partial\gamma} < 0$ if $\gamma \ge \kappa - \epsilon$. So the bidder chooses $\gamma^* < \kappa - \epsilon$. The success probability approaches 0 as N grows large, and the bidder's payoff approaches $\rho\Phi_0$.

Suppose $\rho(\phi_1 - \phi_0) > 0$. There are three subcases:

- Subcase $(\alpha - \eta - \delta + \rho)\phi_1 \le 0$: There exists $\epsilon > 0$ (independent of N) such that $\frac{\partial\pi(\gamma)}{\partial\gamma} > 0$ if $\gamma \le \kappa + \epsilon$. So the bidder chooses $\gamma^* \in (\kappa + \epsilon, 1)$. The success probability approaches 1 as N grows large, while $\Delta \to 0$. From Lemma 1, if the bidder offers $p = \hat{v}_1$ then all shareholders tender with probability 1, and so the bidder's payoff is $N(v_1 + \delta - p) = -(\alpha - \eta - \delta)\Phi_1$. This offer is suboptimal, and so $-(\alpha - \eta - \delta)\Phi_1$ is a lower bound for the bidder's payoff. Hence the bidder's payoff approaches $-(\alpha - \eta - \delta)\Phi_1$ as N grows large (which also establishes that $\gamma^* \to 1$).

- Suppose $0 < (\alpha - \eta - \delta + \rho)\phi_1 < \frac{\rho}{\kappa}(\phi_1 - \phi_0)$. Recall that according to Lemma 3, $\frac{q}{\Delta}$ is strictly increasing in γ (with limits being 0 and ∞). Thus, there exists $\bar{N} > 0$ such that if $N > \bar{N}$ there exists $\epsilon > 0$ (independent of N) such that $\frac{\partial\pi(\gamma)}{\partial\gamma} > 0$ if $\gamma \le \kappa + \epsilon$. So the bidder chooses $\gamma^* \in (\kappa + \epsilon, 1)$. The success probability approaches 1 as N grows large.

- Subcase $(\alpha - \eta - \delta + \rho)\phi_1 \ge \frac{\rho}{\kappa}(\phi_1 - \phi_0)$. There exists $\epsilon > 0$ (independent of N) such that $\frac{\partial\pi(\gamma)}{\partial\gamma} < 0$ if $\gamma \ge \kappa - \epsilon$. So the bidder chooses $\gamma^* \in [0, \kappa - \epsilon)$, the success probability approaches 0 as N grows large, and the bidder's payoff approaches $\rho\Phi_0$.

Suppose $\rho(\phi_1 - \phi_0) < 0$. There are three subcases:

- Subcase $(\alpha - \eta - \delta + \rho)\,\phi_1 \leq \frac{\rho}{\kappa}(\phi_1 - \phi_0)$: There exists $\epsilon > 0$ (independent of N) such that $\frac{\partial \pi(\gamma)}{\partial \gamma} > 0$ if $\gamma \leq \kappa + \epsilon$. So the bidder chooses $\gamma^* \in (\kappa + \epsilon, 1)$. The success probability approaches 1 as N grows large, while $\Delta \to 0$. From Lemma 1, if the bidder offers $p = \hat{v}_1$ then all shareholders tender with probability 1, and so the bidder's payoff is $N(v_1 + \delta - p) = -(\alpha - \eta - \delta)\,\Phi_1$. This offer is suboptimal, and so $-(\alpha - \eta - \delta)\,\Phi_1$ is a lower bound for the bidder's payoff. Hence the bidder's payoff approaches $-(\alpha - \eta - \delta)\,\Phi_1$ as N grows large (which also establishes that $\gamma^* \to 1$).

- Subcase $(\alpha - \eta - \delta + \rho)\,\phi_1 \geq 0$: There exists $\epsilon > 0$ (independent of N) such that $\frac{\partial \pi(\gamma)}{\partial \gamma} < 0$ if $\gamma \geq \kappa - \epsilon$. So the bidder chooses $\gamma^* \in [0, \kappa - \epsilon)$, the success probability approaches 0 as N grows large, and the bidder's payoff approaches $\rho \Phi_0$.

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