# (Ir)responsible Takeovers*

**Philip Bond**[†] **Doron Levit**[‡]

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**Abstract**

We analyze how social preferences shape takeover outcomes in a model with externalities and a finite number of shareholders. Introducing social concerns into the Grossman-Hart framework, we find that the free-riding problem is neither mitigated nor worsened relative to the baseline. However, warm-glow preferences can paradoxically facilitate socially harmful takeovers, as shareholders eagerly divest from firms generating negative externalities. Imbalanced social responsibility between shareholders and bidders drives inefficiency. We apply our framework to pre-takeover trading dynamics, exchange offers, leveraged buyouts, minority shareholder protections, and the strategic use of social responsibility as both a takeover defense and a bidding tactic.

**Keywords:** Takeovers, Mergers and Acquisitions, ESG, Externalities, Corporate Social Responsibility, Responsible Investment, Corporate Governance

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[†]University of Washington. Email: apbond@uw.edu.

[‡]University of Washington. Email: dlevit@uw.edu.

# 1 Introduction

A growing empirical literature documents that some investors care about the externalities that firms impose on workers, consumers, communities, and society at large,[1] in addition to direct financial returns. This evidence raises the question of whether such social preferences shape firm behavior, and if so, through what mechanisms.

Takeovers are moments at which shareholders directly influence the allocation of control over firms and, in doing so, reshape operations while generating significant externalities for a wide range of stakeholders.[2] As such, the market for corporate control is a natural place to look for the real effects of shareholders' social preferences. Such preferences introduce new trade-offs on both sides of a deal. By accepting a large premium, target shareholders sell their cash-flow claims but may facilitate takeovers that generate negative externalities, to which they remain exposed. A socially responsible bidder, meanwhile, considers the broader social impact of the acquisition in addition to its financial payoff.

The contribution of this paper is straightforward to state: we characterize how social preferences over externalities shape takeover outcomes, focusing on canonical economic forces.

Recent evidence suggests that environmental and social considerations play an important role in deal-making.[3] Nonetheless, it remains unclear whether socially conscious shareholders would block value-increasing takeovers that worsen externalities; or facilitate takeovers that improve externalities at a sacrifice in financial value; or how bidders—whether profit-maximizing or socially responsible—would adapt their strategies in light of these new trade-offs. These questions matter more broadly: since managers make decisions in the shadow of potential future bids, the threat of a takeover shapes firm behavior regardless of whether one materializes.

Academic and policy discussions of these important questions are suggestive and informal,

[1] See, for example: Barber et al (2021), Hirst et al (2023), Riedl and Smeets (2017).

[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 changes—both positive (Phillips and Zhdanov 2013) and negative (Cunningham, Ederer, and Ma 2021); environmental consequences such as pollution (Bellon, 2025); 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. 2024; Liu 2022). For recent surveys on takeover externalities, see Golubov (2025) and Sorensen and Yasuda (2023).

[3] For recent empirical evidence see Duchin, Gao, and Xu (2025); Li, Peng, and Yu (2023); Berg, Ma, and Streitz (2023); Deng et al (2013). For recent surveys see Deloitte 2024 M&A ESG Survey and PwC Responsible Investment Survey.

and point in opposite directions. On the one hand, several recent arguments suggest that shareholder social preferences may have limited influence on takeover outcomes, either because of free-riding problems (Hart and Zingales 2017) or because shareholders who divest no longer care about the externalities their former holdings generate (Fox and Patel 2026). On the other hand, a more political and policy-oriented strand of thought argues that socially minded shareholders exert an outsized influence on firms, and push them toward actions that sacrifice value in pursuit of broader goals.[4]

In this paper, we develop an analytical framework to shed light on these competing views and on the economic forces that determine how social preferences shape takeover outcomes. Specifically, we introduce externalities and social preferences into the canonical takeover model of Bagnoli and Lipman (1988), which extends Grossman and Hart's (1980) analysis by considering a tender offer with a finite number of target shareholders, thereby incorporating pivotal decision-making. Analyzing a finite-agent setting proves essential: without social preferences, the limit of equilibria in finite-agent economies coincides with an equilibrium of the price-taking limit, but this equivalence fails in many cases once social preferences are introduced.[5]

We emphasize five points. First, the free-riding problem associated with takeovers that affect externalities is neither milder nor stronger than in the baseline case in which takeovers affect only financial value. This equivalence is not obvious. Consider a takeover that increases a target firm's value (e.g., via synergies), yet worsens externalities by enough to reduce shareholder welfare. 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 premium bid. However, the classic "holdout" problem identified by Grossman and

[4]See, e.g., Oaks and Russ (2023): Wall Street Journal, A Historic Breach of Fiduciary Duty. More broadly, the effectiveness of responsible investment is a topic of ongoing research and debate. Several studies find limited impact: Berk and van Binsbergen (2025) 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 (2025) 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).

[5]For example, a takeover that reduces shareholder value but raises shareholder welfare, with consequentialist target shareholders and a purely financial bidder, succeeds with approximately 50% probability in the finite-agent economy yet fails with certainty in the price-taking limit.

Hart creates opposing incentives—each shareholder is tempted to decline the offer and become a minority owner in the post-takeover firm, thereby capturing the full cash flow improvement. This holdout incentive offsets the public goods free-rider problem, and safeguards against socially harmful takeovers.[6] When the social preferences of target shareholders and the bidder are *balanced* in the sense that externalities that shareholders ignore upon divestment are internalized by the bidder upon acquisition, the severity of the free-riding problem remains exactly the same. Overall, introducing social preferences over externalities has less effect on the classic logic of tender offers than one might initially suspect.

Second, when shareholders have warm-glow preferences, meaning that they prefer to hold shares of firms that generate positive externalities and avoid those that cause harm, social concerns affect takeover outcomes more strongly than our first result suggests. In particular, if a takeover leads to negative externalities then socially minded shareholders may actively want to sell their shares—being a minority shareholder in a post-takeover firm is particularly undesirable. In this case, the bidder benefits not only from the financial gains associated with acquiring control, but also from shareholders' desire to divest from firms whose future conduct they dislike.

In this way, our model establishes a channel via which social preferences lower the barrier to socially harmful takeovers. While the Grossman-Hart framework typically predicts shareholder holdouts, the presence of negative externalities—coupled with warm-glow preferences—exacerbates the public-good free-rider problem by creating an additional incentive to divest. Consequently, a socially harmful takeover may succeed not in spite of shareholders' social concerns, but precisely because of them.[7]

More broadly, and perhaps surprisingly, we show that greater social responsibility on the part of shareholders and bidders need not improve efficiency and can, in some cases, lead to

[6]An analogous argument applies to takeovers where positive externalities raise shareholder welfare despite reducing firm value.

[7]A leading case that can be explained through the lens of our model is Philip Morris International's (PMI) 2021 acquisition of Vectura Group for £1.1 billion. The deal saw a global tobacco giant take control of a specialist in inhaled medicines for asthma and COPD, health conditions closely linked to smoking. The 165p offer came at a premium but still fell short of Vectura's 2019-2020 highs above 200p per share. Vectura's shareholders faced a stark dilemma, highlighted by 35 health organizations that warned that accepting PMI's offer would enable significant public-health harm. Nevertheless, the deal secured 75% shareholder approval, and was backed by many ESG-branded institutions whose mandates nominally excluded tobacco. See Article 1, Article 2, Article 3, and Article 4.

inefficient outcomes. The key insight is that efficiency depends not only on the degree to which externalities are internalized, but also on the *balance* of social responsibility between target shareholders and bidders. We demonstrate that imbalances in warm-glow social preferences can generate cycles of deal-making where assets are repeatedly acquired and sold back, leading to excessive takeover activity without corresponding economic benefits. Taken together, our results suggest that socially efficient outcomes require alignment between the social objectives of the financial sector, including asset-manager mandates, and those of the corporate sector.

Third, we show that if bidders have consequentialist preferences then these preferences act like a private benefit/cost of control, depending on whether a takeover generates positive/negative externalities. Bidders that internalize externalities independently of ownership derive value from control not only by affecting financial cash flows, but also by affecting a firm's behavior. Viewed this way, the classic free-rider logic yields a sharp implication: takeover outcomes are driven by the bidder's assessment of a target's externalities, largely independent of the financial value created or destroyed by the acquisition.

The case in which the bidder and target shareholders are both consequentialist, and target shareholders are widely dispersed ($N$ large) is especially stark. A natural conjecture is that free-riding implies that a takeover's viability is determined entirely by its effect on financial values, with any effect on externalities being irrelevant. But our analysis implies exactly the opposite, viz., a takeover's outcome is determined entirely by whether or not it improves externalities, with the effect on financial values irrelevant.

Fourth, we speak to a common argument about whether the presence of hedge funds in financial markets dilutes or even nullifies the impact of responsible investment. To examine this in the context of takeovers, we consider a scenario in which target shareholders may sell their shares to purely financial investors before a 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 large premiums that socially responsible investors might demand to give up shares in socially virtuous firms. In this way, non-social capital can help correct inefficiencies caused by imbalanced social preferences.

Fifth, our analysis yields fresh insights on several classic topics in the takeover literature. The method of payment takes on a new role in the presence of externalities: bidders prefer cash when a takeover generates negative externalities and equity when externalities are positive. Leverage enables the bidder to tunnel out firm value. This effect cuts both ways, because it facilitates not-only surplus-increasing takeovers, as discussed in existing literature; but also surplus-decreasing takeovers, exactly as critics of LBOs frequently allege. We apply our analysis to the design of minority shareholder protections. Finally, de facto takeover defenses can be obtained by the strategic manipulation of externalities.

Overall, we sharply characterize when shareholder concerns for externalities meaningfully affect control outcomes, when it does not, and when the preferences of bidders rather than shareholders are decisive. More broadly, the paper contributes to the growing literature on the real consequences of investor social preferences by showing how those preferences interact with one of corporate finance's central mechanisms for reallocating control.

## Related Literature

Our paper is related to two main strands of literature. First, we contribute to the theoretical literature on takeovers. In addition to Bagnoli and Lipman (1988), variants of tender offer models with a finite number of shareholders are studied by Holmstrom and Nalebuff (1992), Gromb (1993), Cornelli and Li (2002), Marquez and Yilmaz (2008), Dalkır and Dalkır (2014), Dalkır (2015), Ekmekci and Kos (2016), Dalkır, Dalkır, and Levit (2019), and Voss and Kulms (2022). Unlike these studies, we examine the effects of takeover externalities and social preferences on the takeover dynamics.[8] Our analysis also highlights the importance of modeling a finite-agent economy when shareholders have social preferences. As noted above, in the benchmark case without social preferences, the limit of equilibria in finite-agent economies coincides with an equilibrium of the corresponding price-taking economy. With social preferences, how-

[8]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), Hirshleifer and Titman (1990), Kyle and Vila (1991), Burkart, Gromb, and Panunzi (1998, 2000), Mueller and Panunzi (2004), Marquez and Yilmaz (2012), Gomes (2001), At, Burkart and Lee (2011), Burkart et al. (2014), Levit (2017), Burkart and Lee (2015, 2022), Burkart, Lee and Petri (2023), and Burkart, Lee and Voss (2024).

ever, this equivalence may fail, implying that the price-taking limit can miss important features of takeover outcomes. Related work examines models with a finite numbers of socially responsible agents in non-takeover contexts. Kaufmann, Andre, and Kőszegi (2024) analyze consumer behavior in competitive product markets, while Lee and Wang (2026) study socially responsible depositors during bank runs. Meirowitz, Pi, and Ringgenberg (2023) study voting over corporate policies when investors balance firm profits against social impact.

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 (2025), Edmans, Levit, and Schneemeier (2022), Landier and Lovo (2025), Green and Roth (2025), and Chowdhry, Davies, and Waters (2019), Huang and Kopytov (2022), Gupta, Kopytov and Starmans (2025), 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). Broccardo, 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).

# 2 Model

There are $N \geq 2$ shareholders, 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 per-share financial 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, which for comparability with financial values we write in per-share terms. The per-share externality is $\phi = \phi_0$ under the incumbent, and will change to $\phi = \phi_1$ if the firm is acquired by the bidder.

The bidder makes a cash tender offer $p$ per share. The takeover is successful, and the bidder gains control of the firm if at least $K = \kappa N$ shares are tendered, where $\kappa \in (0, 1)$ is the majority rule. The bidder's offer is conditional on success; if fewer than $K$ shares are tendered, the bidder doesn't acquire any shares and the takeover fails. If $K$ or more shares are tendered, the bidder buys all tendered shares, the takeover succeeds, and any shareholders who did not tender retain their shares and become minority holders. Conditional offers of this kind are the most common form of tender offer in practice.[9]

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

As discussed in the introduction, our goal is to study the consequences of target shareholders taking seriously the externalities generated by a firm. Accordingly, a shareholder's utility depends on the combination of the financial value of shares and the firm's externalities. Let $\alpha_T$ be the weight on externalities in a shareholders utility; so the utility of a shareholder in the target is $v_0 + \alpha_T \phi_0$ under incumbent management and $v_1 + \alpha_T \phi_1$ under the bidder's control. Shareholders who tender give up their ownership stake in the target, and may feel less responsible for negative externalities (or less pride from positive externalities); this possibility is often referred to as shareholders having *warm-glow* preferences.[10] To capture this possibility: if the bid succeeds then a tendering shareholder's perceived utility from the externalities is $(\alpha_T - \delta_T)\,\phi_1$, where $\delta_T \in [0, \alpha_T]$ parameterizes the extent of warm-glow preferences.[11] The case $\delta_T = 0$ corresponds to target shareholders having pure *consequentialist* preferences, and the case $\delta_T = \alpha_T$ corresponds to target shareholders having pure *warm-glow* preferences. The term $\alpha_T - \delta_T$ captures the shareholder's *ownership invariant* social preferences.

The preference parameters $\alpha_T$ and $\delta_T$ potentially depend on $N$. Two cases in particular are worth highlighting. First, the leading case in which $\alpha_T$ and $\delta_T$ are invariant to $N$ arises if a shareholder's total wealth scales proportionally with ownership $1/N$ of the target, and if the relative weights that shareholders place on personal consumption and social externalities are independent of wealth (see Online Appendix E for microfoundation). Similarly, this case

[9]Online Appendix D compares conditional and unconditional offers.

[10]See Andreoni (1990)'s assumption that charitable giving directly delivers "warm glow" utility to the giver; and Hong and Kacperczyk's (2009) hypothesis (and evidence) that investors incur disutility from holding stocks with negative externalities.

[11]If $\delta_T < 0$, shareholders internalize externalities more when selling than when retaining ownership, potentially reflecting a sense of moral responsibility for outcomes they have actively enabled. Our framework accommodates this case, though we do not explore it further.

arises if shareholders are intermediaries who hold shares on behalf of end-investors, so that larger values of $N$ correspond to each intermediary representing a smaller number of end-investors. This case has the appealing property that the relative weight that the coalition of all shareholders puts on financial value vs externalities is independent of $N$. Second, $\alpha_T \equiv N\bar{\alpha}_T$ and $\delta_T \equiv N\bar{\delta}_T$ arises if larger values of $N$ correspond to greater diversification, but with each shareholder caring about the total (as opposed to per-share) externalities of the firm, viz., $\Phi_0 \equiv N\phi_0$ and $\Phi_1 \equiv N\phi_1$. The (in)dependence of $\alpha_T$ and $\delta_T$ to $N$ matters only for a few of our results (see section 7.1).

A takeover changes *shareholder value* (per-share) by $v_1 - v_0$, which is the focus of existing literature. Its analogue in the case in which shareholders have preferences over externalities is

$$s_T \equiv v_1 - v_0 + \alpha_T(\phi_1 - \phi_0). \tag{1}$$

In words, $s_T$ is the change in the *welfare* of a target shareholder who retains shares, in the case in which a takeover succeeds, and again expressed on a per-share basis. This term plays a central role in our analysis.

Similar to target shareholders, the bidder (or its shareholders) cares about both the financial payoff from a successful takeover and its impact on externalities. Specifically, the bidder's payoff per acquired share in a successful takeover is $v_1 - p + \alpha_B\phi_1$, while its payoff per non-acquired share is $(\alpha_B - \delta_B)\,\phi_1$ if the takeover succeeds, and $(\alpha_B - \delta_B)\,\phi_0$ if it fails. Parameter $\delta_B \in [0, \alpha_B]$ governs the extent of the bidder's warm-glow preferences, analogous to target shareholders' warm-glow parameter $\delta_T$; the case $\delta_B = 0$ ($\delta_B = \alpha_B$) corresponds to the bidder having pure consequentialist (warm-glow) preferences, and $\alpha_B - \delta_B$ is the part of the bidder's preferences that is ownership invariant. The model of Bagnoli and Lipman (1988) is a special case in which $\alpha_T = \delta_T = \alpha_B = \delta_B = 0$, or alternatively $\phi_0 = \phi_1 = 0$.

Before proceeding, we highlight two key respects in which a firm's externalities $(\phi_0, \phi_1)$ conceptually differ from its cash flows $(v_0, v_1)$. First, tendering shareholders do not care about post-takeover cash flows $v_1$, but (provided $\alpha_T - \delta_T > 0$) they do care about post-takeover externalities $\phi_1$. Second, the bidder's weights on cash flows $v_1$ and externalities $\phi_1$ generally differ from target shareholders' weights.

# 3 Analysis

We focus on symmetric Nash equilibria, as standard in the literature, and denote the equilibrium offer and tendering strategy by $(p^*, \gamma^*)$.

## 3.1 Preliminaries

We introduce notation that we use throughout. 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 takeover 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 takeover if shareholder $i$ tenders; and if all shareholders tender with probability $\gamma$ then the takeover 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 $\gamma$ in the functions $q, \Delta$, and $\Lambda$.

## 3.2 Benchmark: No-externalities

As a benchmark, consider the case in which the target firm generates no externalities under either the incumbent or bidder, so that the social preferences are irrelevant. Because the bidder's ownership-invariant social preferences will have qualitatively similar effects, we consider a bidder that obtains private benefits (or incurs private costs) of magnitude $Nb$, contingent on the takeover succeeding. Let $\gamma^*_{ne}$ and $\Lambda^*_{ne}$ denote the equilibrium tendering probability and takeover success probability in this no-externalities benchmark.

**Proposition 1** *Suppose* $\phi_0 = \phi_1 = 0$.

(*i*) *Suppose* $v_1 < v_0$*. If* $b + v_1 - v_0 \leq 0$*, then* $\gamma^*_{ne} = 0$ *is an equilibrium. If* $b > 0$*, then* $\gamma^*_{ne} = 1$ *is an equilibrium. No other equilibrium exists.*

(*ii*) *Suppose* $v_1 \geq v_0$*. The unique equilibrium is*

$$\gamma^*_{ne} = \max\left\{0, \kappa + (1-\kappa)\frac{b}{v_1 - v_0 + b}\right\} \tag{5}$$

*and* $\lim_{N\to\infty} \Lambda^*_{ne} = \frac{1+sign(b)}{2}$.[12]

This benchmark case is covered by Bagnoli and Lipman (1988). Takeovers that decrease shareholder value ($v_1 < v_0$) fail unless the bidder has private benefits from control ($b > 0$), while takeovers that increase shareholder value ($v_1 > v_0$) succeed with a strictly positive probability unless the bidder's private costs are sufficiently large ($b \leq -\kappa(v_1 - v_0)$). Bagnoli and Lipman also establish that as the target's ownership becomes increasingly dispersed the bidder's profits converge to $\max\{0, b\}$, 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 as a function of that shareholder's tendering decision, taking as given that all $N-1$ other shareholders tender with probability $\gamma$. Since the offer is conditional, a shareholder's utility if the takeover fails is $v_0 + \alpha_T\phi_0$ irrespective of his tendering decision. Thus, if a shareholder retains his share, the takeover succeeds with probability $q$, and the shareholder's expected utility increases by

$$q\left[v_1 - v_0 + \alpha_T(\phi_1 - \phi_0)\right] = qs_T, \tag{6}$$

reflecting that if the takeover 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 takeover.[13] If instead the shareholder tenders, the takeover succeeds with probability $q + \Delta$,

[12] The range of the function $sign(\cdot)$ is $\{-1, 0, 1\}$.

[13] Online Appendix C analyzes freeze-out mergers, in which retaining shareholders are forced to tender with some probablity.

and his expected utility increases by

$$(q + \Delta) \left[ p - v_0 + (\alpha_T - \delta_T) \phi_1 - \alpha_T \phi_0 \right]. \tag{7}$$

Expression (7) reflects both the fact that the offer is conditional and so a shareholder receives $p$ only with probability $q + \Delta$; and also that because tendering involves divestment, the weight placed on externalities drops by $\delta_T$.

Consequently, a shareholder's net gain from tendering is

$$\tau(\gamma; p) \equiv \Delta s_T - (q + \Delta)(v_1 + \delta_T \phi_1 - p). \tag{8}$$

Equation (8) 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 $\Delta s_T$ to shareholder welfare. The cost of this contribution corresponds to the foregone private value identified by Grossman and Hart, namely $v_1 - p$, adjusted for $\delta_T \phi_1$, the change in the shareholder's concern for externalities resulting from divesting the share.

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

Expression (8) highlights that a shareholder's total utility from a successful takeover, $v_1 + \alpha_T \phi_1$, *isn't* a sufficient statistic for the gain to tendering $\tau$. The economic reason is that, provided that $\alpha_T - \delta_T > 0$, tendering shareholders care about the externalities $\phi_1$ generated by the takeover, 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

$$\tau(\gamma^*; p) = 0. \tag{9}$$

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 (but doesn't eliminate) equilibrium multiplicity. 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. Graphically, an equilibrium is stable if $\tau(\cdot; p)$ crosses zero from above. Formally:

*Stability condition:* An equilibrium $\gamma^*$ 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 $\tau(\gamma^* + \epsilon; p) < 0$.

Hereafter, we refer to a stable equilibrium simply as an equilibrium.

**Lemma 1** *An equilibrium $\gamma^*$ of the tendering subgame exists. If $s_T < 0$, then*

$$\gamma^* = \begin{cases} 0 & \textit{if } p \leq v_1 + \delta_T \phi_1 \\ \{0,1\} & \textit{if } p \in (v_1 + \delta_T \phi_1, v_1 + \delta_T \phi_1 - s_T) \\ 1 & \textit{if } p \geq v_1 + \delta_T \phi_1 - s_T. \end{cases} \tag{10}$$

*If $s_T > 0$, define*

$$\mu(\gamma) \equiv v_1 + \delta_T \phi_1 - \frac{\Delta}{q + \Delta} s_T; \tag{11}$$

*then*

$$\gamma^* = \begin{cases} 0 & \textit{if } p \leq v_1 + \delta_T \phi_1 - s_T \\ \mu^{-1}(p) \in (0,1) & \textit{if } p \in (v_1 + \delta_T \phi_1 - s_T, v_1 + \delta_T \phi_1) \\ 1 & \textit{if } p \geq v_1 + \delta_T \phi_1. \end{cases} \tag{12}$$

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

If $s_T > 0$, 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 $s_T < 0$, a mixed-strategy equilibrium doesn't exist.[14] Instead everyone-retaining ($\gamma^* = 0$) and

[14] Focusing on stable equilibria eliminates the mixed-strategy equilibrium when $s_T < 0$.

everyone-tendering ($\gamma^* = 1$) coexist as equilibria for moderate offers

$$p \in (v_1 + \delta_T \phi_1, v_1 + \delta_T \phi_1 - s_T). \tag{13}$$

From (8), this case is the reverse of the well-known holdout problem. Specifically, the individual cost of tendering is the increased probability of an undesirable takeover with $s_T < 0$ occurring; while the individual benefit is that, conditional on takeover success, a shareholder gets $p$ instead of the preference-shift-adjusted post-takeover value $v_1 + \delta_T \phi_1$. Consequently, if an individual shareholder anticipates a low takeover probability then retention dominates tendering, while the reverse is true if a high takeover 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 post-takeover value $v_1$, but bidders never make such an offer absent any private benefits of control.

## 3.4 Bidder's payoff

The bidder's expected payoff from making an offer to an individual shareholder, conditional on all shareholders following tendering strategy $\gamma$, is

$$\gamma (q + \Delta) (v_1 - p + \alpha_B \phi_1) + (1 - \gamma) q (\alpha_B - \delta_B) \phi_1 + (1 - \Lambda) (\alpha_B - \delta_B) \phi_0. \tag{14}$$

With probability $\gamma (q + \Delta)$, the shareholder tenders and the takeover succeeds; in this case, the bidder earns a profit of $v_1 - p$ per share along with additional utility $\alpha_B \phi_1$. With probability $(1 - \gamma) q$ the shareholder doesn't tender yet the takeover succeeds, yielding the bidder a utility of $(\alpha_B - \delta_B) \phi_1$ on the non-acquired share. In all remaining cases the takeover fails; because the offer is conditional, the bidder does not acquire the share and obtains utility $(\alpha_B - \delta_B) \phi_0$.

Given that there are $N$ shareholders making independent tendering decisions, the bidder's expected total payoff is simply $N$ times the expected payoff (14). Naturally, the bidder's payoff depends on the spread between post-takeover cash flows $v_1$ and the offer $p$. From (8), this same spread affects a target shareholder's gain $\tau$ from tendering. Consequently, whenever the equilibrium condition (9) holds, the bidder's expected payoff is $N$ times

$$\gamma \Delta s_T + \gamma (q + \Delta)(\delta_B - \delta_T) \phi_1 + \Lambda \beta + (\alpha_B - \delta_B) \phi_0, \tag{15}$$

where

$$\beta \equiv (\alpha_B - \delta_B)(\phi_1 - \phi_0), \tag{16}$$

with $\mathcal{B} \equiv N\beta$. To understand (15) it is helpful to consider first the case of target shareholders with pure consequentialist preferences ($\delta_T = 0$) and a bidder motivated purely by profit ($\alpha_B = \delta_B = 0$). In this case, (15) reduces to simply its first term, $\gamma \Delta s_T$. As we noted above, the post-takeover cash flows $v_1$ and externalities $\phi_1$ have different "exclusion" characteristics: tendering shareholders are excluded from $v_1$, leading to the holdout problem, but aren't excluded from $\phi_1$. The important implication of (8) 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, $\Delta s_T$, with the cost, $(q + \Delta)(v_1 - p)$. In particular, for any given tendering probability $\gamma$, shareholder welfare $s_T$ directly determines the spread $v_1 - p$ that the bidder makes on each share acquired. Thus, even a profit-maximizing bidder indirectly and partially internalizes a takeover's externalities.[15]

The second term in (15) can be understood by considering perturbations away from the benchmark just described. A bidder's warm-glow preferences over externalities ($\delta_B > 0$) change the bidder's payoff exactly as one would expect. Perhaps less immediate, warm-glow preferences for target shareholders ($\delta_T > 0$) force the bidder to increase its offer if post-takeover externalities $\phi_1$ are positive, since shareholders have a direct incentive to retain their shares in this case.

The third and fourth terms in (15) capture the bidder's preferences over externalities that are independent of ownership. When $\alpha_B > \delta_B$, the bidder derives utility $(\alpha_B - \delta_B)\phi_0$ regardless of the takeover outcome, since this externality obtains whether or not the bid succeeds. If the takeover succeeds, which occurs with probability $\Lambda$, the bidder additionally gains $\beta$, re-

[15]Expression (15) also underscores the importance of assuming a finite number of shareholders. Under a continuum of shareholders, no individual shareholder is pivotal for the outcome, implying $\Delta = 0$. As a result, the social surplus $s_T$ drops out of the analysis entirely. This stands in sharp contrast to Theorem 1 below: with a continuum of consequentialist shareholders, there always exists an equilibrium in which a socially inefficient takeover by a profit-maximizing bidder succeeds.

flecting the change in externalities. In this respect, when the takeover increases (decreases) the target's externalities, the bidder's ownership invariant-preferences operate similarly to private benefits (costs) of control, as captured by $\beta$.

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

$$\Pi(\gamma;p)=N\times\begin{cases}\gamma\Delta s_T+\gamma(q+\Delta)(\delta_B-\delta_T)\phi_1+\Lambda\beta+(\alpha_B-\delta_B)\phi_0 & \text{if }\gamma\in[0,1)\\ v_1-p+\alpha_B\phi_1 & \text{if }\gamma=1.\end{cases}\tag{17}$$

# 4 Equilibrium and takeover efficiency

The next result characterizes the equilibrium of the overall game. We write $\Lambda^*$ and $\Pi^*$ for the probability a takeover succeeds and for the bidder's expected payoff in equilibrium, respectively.

**Theorem 1**

(*i*) *Suppose* $s_T<0$. *If* $s_T+\beta+(\delta_B-\delta_T)\phi_1\leq 0$ *then* $\gamma^*=\Lambda^*=0$ *is an equilibrium; and* $\Pi^*=(\alpha_B-\delta_B)\Phi_0$. *If* $\beta+(\delta_B-\delta_T)\phi_1>0$, *then* $\gamma^*=\Lambda^*=1$ *is an equilibrium; the bidder's payoff* $\Pi^*$ *depends on the offer, but any* $\Pi^*\in[(\alpha_B-\delta_B)\Phi_0,\mathcal{B}+(\delta_B-\delta_T)\Phi_1+(\alpha_B-\delta_B)\Phi_0)$ *can be supported. No other equilibrium exists.*

(*ii*) *Suppose* $s_T>0$. *If* $(\delta_T-\delta_B)\phi_1\geq(\leq)0$ *then*

$$\gamma^*\leq(\geq)\max\left\{0,\kappa+(1-\kappa)\frac{\beta}{s_T+\beta}\right\},\tag{18}$$

*where* (18) *is at equality if* $(\delta_T-\delta_B)\phi_1=0$ *and holds strictly if both* $(\delta_T-\delta_B)\phi_1$ *and the RHS of* (18) *are non-zero.*

(*iii*) *If* $\alpha_T$ *and* $\delta_T$ *are independent of* $N$ *then so is* $s_T$; *if* $s_T>0$ *then*

$$\lim_{N\to\infty}\Lambda^* = \begin{cases}0 & \textit{if } \beta+\max\{(\kappa\delta_B-\kappa\delta_T)\phi_1,(\delta_B-\delta_T)\phi_1\}<0\\ 1 & \textit{if } \beta+\max\{(\kappa\delta_B-\kappa\delta_T)\phi_1,(\delta_B-\delta_T)\phi_1\}>0\end{cases}\tag{19}$$

$$\lim_{N\to\infty}\Pi^*=\max\{0,\mathcal{B}+(\kappa\delta_B-\kappa\delta_T)\Phi_1,\mathcal{B}+(\delta_B-\delta_T)\Phi_1\}+(\alpha_B-\delta_B)\Phi_0.\tag{20}$$

Parts (i) and (ii) are independent of whether and how the preference parameters scale with $N$. If $s_T < 0$ then part (i) directly gives the takeover probability and bidder's payoff. If $s_T > 0$, for the leading case in which preference parameters are independent of $N$, part (iii) characterizes the takeover probability for large $N$. In section 7.1 we consider the alternate case in which target shareholders' preference parameters scale with $N$.

Going forward, we use $s_T$ as our welfare criterion. Recall that $s_T$ measures the change in welfare for retaining target shareholders resulting from the takeover. In equilibrium, shareholders are indifferent between tendering and retaining their shares; therefore, $s_T$ also captures the welfare gains or losses for tendering shareholders.

Moreover, if $\alpha_T$ is sufficiently close to one, the sign of $s_T$ coincides with that of the change in social welfare, defined as

$$N(v_1 - v_0 + \phi_1 - \phi_0), \tag{21}$$

thereby extending the normative implications of our analysis.

Theorem 1 has several interesting implications, which we present as a series of corollaries—each effectively a special case.

### 4.1 Balanced preferences: $\delta_T = \delta_B$

We first consider the case in which shareholders' and the bidder's social preferences exactly balance out in the sense that any externalities that shareholders ignore upon divestment (because $\delta_T \geq 0$) are picked up by the bidder (since $\delta_T = \delta_B$). In other words, ownership transfers do not affect how externalities are internalized in the aggregate. This case serves as an important benchmark, and elucidates economic forces that shape outcomes more generally.

**Corollary 1** *If $\delta_T = \delta_B$, the equilibrium set with externalities coincides with the no-externalities benchmark (Proposition 1), i.e., $\gamma^* = \gamma^*_{ne}$, with $b$ replaced by $\beta$ and $v_1 - v_0$ replaced by $s_T$.*

A leading case of balanced preferences involves target shareholders with purely consequentialist preferences ($\delta_T = 0$) and a purely profit-motivated bidder ($\alpha_B = \delta_B = 0$).

Corollary 1 first says that, no matter how dispersed shareholders are, a takeover that reduces shareholder welfare is always blocked. To better understand this result, consider a takeover that increases shareholder value ($v_1 > v_0$) but is sufficiently socially costly ($\phi_1 < \phi_0$) that it decreases shareholder welfare ($s_T < 0$). 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 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 each individual shareholder is tempted to holdout and become a minority shareholder in the acquired firm, thereby benefiting from the increase in private value $v_1 - v_0$ rather than accepting 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 implies that takeovers that increase shareholder welfare ($s_T > 0$) succeed with exactly the same probability as takeovers that increase shareholder value would in the absence of social preferences over externalities. To better understand this result, consider the opposite scenario from that discussed above: a takeover that reduces shareholder value ($v_1 < v_0$) but that generates sufficient social benefits ($\phi_1 > \phi_0$) to raise shareholder welfare ($s_T > 0$). 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 takeover would fail, on the grounds that even socially responsible shareholders might individually reason that they have little ability to affect the takeover'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 takeover 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 takeover 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 tender even when the offered premium is minimal or negative.

These arguments generalize to any case in which the bidder's and shareholders' warm-glow preferences are balanced in the sense that $\delta_T = \delta_B$. In words, Corollary 1 says that externalities are fully internalized, in the sense that the market for corporate control delivers the same outcome as if shareholders' preferences over externalities $\alpha_T \phi$ were replaced with their monetary equivalents, so that shareholder value and shareholder welfare coincide.[16]

[16] When $\delta_T = \delta_B = \alpha_B$, it turns out that there is an easy way to map the standard setting without

Finally, Corollary 1 implies that the bidder's ownership-invariant preferences ($\alpha_B - \delta_B > 0$) function as a private benefit when the takeover is expected to increase firm's externalities ($\phi_1 > \phi_0$), and as a private cost when it is expected to decrease them ($\phi_1 < \phi_0$). Accordingly, when target ownership is widely dispersed ($N \to \infty$), the bidder's expected payoff converges to $(\alpha_B - \delta_B)\max\{\Phi_1, \Phi_0\}$. As $N$ grows large, the probability $\Delta$ that an individual shareholder is pivotal converges to zero, and the bidder cannot profit from the takeover due to the hold-out problem. Importantly, without any source of profit, the bidder's incentive to complete the takeover derives solely from $\beta$. Therefore, when $\alpha_B - \delta_B > 0$, takeovers that increase shareholder welfare ($s_T > 0$) succeed if and only if they improve the target's externalities. In particular, takeovers with $s_T > 0$ that worsen externalities fail in spite of the fact that target shareholders find the tradeoff between improved value and worsened externalities worthwhile. Similarly, there is an equilibrium in which a takeover with $s_T < 0$ but that improves externalities succeeds, because of the pressure-to-tender effect.

## 4.2 Internalization losses, $\delta_T > \delta_B$

Corollary 1's "full internalization" implication establishes that takeover outcomes align closely with shareholder welfare. The main threat to shareholder welfare arises from bidders with ownership invariant social preferences that decline to pursue takeovers that would increase shareholder welfare $s_T$ at the expense of worsening externalities, but that "force through" takeovers that improve externalities at the expense of shareholder welfare.

If instead target shareholders have stronger warm-glow preferences than the bidder ($\delta_T > \delta_B$) then a distinct threat to shareholder welfare arises because a takeover reduces the collective weight that a firm's owners place on externalities. The result of this shift in preferences is that takeovers that result in positive (negative) externalities face headwinds (benefit from tailwinds).

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 $\bar{\phi}_0 = \bar{\phi}_1 = 0$, $\tilde{v}_0 + \alpha_T \tilde{\phi}_0 = \bar{v}_0$ and $\tilde{v}_1 + \alpha_T \tilde{\phi}_1 = \bar{v}_1$. 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 (11), an offer $\tilde{p} = \bar{p} - (\alpha_T - \delta_T)\tilde{\phi}_1$ 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 $(\alpha_T - \delta_T)\tilde{\phi}_1 = \alpha_T \tilde{\phi}_1 - \delta_B \tilde{\phi}_1$ less for a firm that generates $\alpha_T \tilde{\phi}_1$ less of pecuniary value but $\delta_B \tilde{\phi}_1$ more of warm-glow utility.

**Corollary 2** *If $\delta_T > \delta_B$, relative to the no-externalities benchmark (Proposition 1), takeovers with positive externalities ($\phi_1 > 0$) are more likely to fail (i.e., $\gamma^* \leq \gamma^*_{ne}$), while takeovers with negative externalities ($\phi_1 < 0$) are more likely to succeed (i.e., $\gamma^* \geq \gamma^*_{ne}$), with $b$ replaced by $\beta$ and $v_1 - v_0$ replaced by $s_T$.*[17]

Corollary 2 highlights the outsized role of post-takeover externalities $\phi_1$ in determining the success of a takeover, along with the perverse consequences that follow. This is especially stark when the status quo carries zero externalities ($\phi_0 = 0$). In this case, takeovers that worsen externalities ($\phi_1 < 0$) are more likely to succeed while those that improve externalities ($\phi_1 > 0$) are more likely to be blocked, regardless of the effect on either shareholder value or shareholder welfare. Indeed, Corollary 2 predicts that firms producing negative externalities are more likely to be acquired even absent any change in either pecuniary value or in externalities (i.e., $v_1 = v_0$ and $\phi_1 = \phi_0 < 0$).

To understand these observations, suppose $\phi_1 < 0$. Socially-minded shareholders dislike holding the share, and crucially, if $\delta_T > 0$, tendering offers them relief from this dislike—giving them a direct motive to tender and allowing the bidder to shade down its bid. If the bidder's own aversion to negative externalities is sufficiently small ($\delta_B < \delta_T$), the discount it extracts more than compensates for its additional exposure to the target's negative externalities, thereby facilitating the takeover even when it is bad for shareholder welfare. Essentially, when $\delta_B < \delta_T$, a takeover reduces the aggregate internalization of externalities, thereby facilitating takeovers that result in negative externalities.

Moreover, if the bidder has pure warm-glow preferences ($\delta_B = \alpha_B$) and $\phi_1 < 0$, then as ownership becomes widely dispersed ($N \to \infty$), any takeover with $s_T > 0$ always succeeds; but any takeover with $s_T < 0$ can *also* always succeed, in the sense that there is an equilibrium supporting this outcome.[18] Importantly, the direct motive to tender that arises from warm-glow preferences and negative post-takeover externalities operates regardless of whether an individual shareholder is pivotal. Hence, the bidder can extract a discount even when ownership is widely dispersed. At the same time, the holdout and public-good free-rider problems prevent

[17]When $s_T < 0$, multiple equilibria may exist, and in these cases, a takeover is more (less) likely to succeed in the sense that the parameter set supporting $\gamma^* = 1$ equilibrium expands (shrinks), while the parameter set supporting $\gamma^* = 0$ equilibrium correspondingly shrinks (expands).

[18]These results continue to hold even if the bidder cares about externalities generated by a firm that it doesn't own ($\alpha_B - \delta_B > 0$), provided these are sufficiently mild. With such preferences, the bidder also internalizes the difference $\phi_1 - \phi_0$.

the bidder from benefiting from $s_T > 0$. Consequently, the discount stemming from warm-glow shareholders' direct motive to tender dominates. In particular, the bidder's payoff $\Pi^*$ approaches $\max\{0, (\delta_B - \delta_T)\,\Phi_1\}$ as $N \to \infty$. Thus, if $\phi_1 < 0$, the bidder's payoff is strictly positive even when the target's ownership is widely dispersed. Notably, this result does not hinge on the bidder's social preferences per se: even a purely profit-maximizing bidder ($\alpha_B = \delta_B = 0$) earns a strictly positive payoff in the limit.

The case of positive post-takeover externalities ($\phi_1 > 0$) is directly analogous. Warm-glow preferences now induce a direct motive for shareholders to retain their shares. To overcome this, the bidder must offer a large premium. Yet when ownership is widely dispersed, the holdout and free-rider problems imply that the bidder captures little of the value created. If the bidder's warm-glow sensitivity to positive externalities is sufficiently small ($\delta_B < \delta_T$), it lacks the incentive to offer the premium required to overcome shareholders' desire to retain shares, thereby impeding the takeover, even if it's expected to increase shareholder welfare ($s_T > 0$).

## 4.3 Internalization gains, $\delta_T < \delta_B$

When ownership transfers from target shareholders to the bidder increase aggregate externality internalization, the conclusions of Corollary 2 are reversed:

**Corollary 3** *If $\delta_T < \delta_B$, relative to the no-externalities benchmark (Proposition 1), takeovers with positive externalities ($\phi_1 > 0$) are more likely to succeed (i.e., $\gamma^* \geq \gamma^*_{ne}$), while takeovers with negative externalities ($\phi_1 < 0$) are more likely to fail (i.e., $\gamma^* \leq \gamma^*_{ne}$), with $b$ replaced by $\beta$ and $v_1 - v_0$ replaced by $s_T$.*

The economic forces underlying Corollary 3 are analogous to those underlying Corollary 2. The most transparent case is that of target shareholders with purely consequentialist preferences ($\delta_T = 0$) and a bidder with warm glow preferences ($\delta_B > 0$). In this case, shareholders derive no direct benefit from offloading shares with negative externalities, nor do they experience any direct reluctance to surrender shares with positive externalities. However, with warm-glow preferences, the bidder is willing to pay a larger (smaller) premium for takeovers yielding positive (negative) externalities (i.e., $\phi_1 > 0$ ($\phi_1 < 0$)), making those takeovers more (less) likely to succeed.

These observations extend to the case in which target shareholders also have warm-glow preferences ($\delta_T > 0$), so long as they are weaker than the bidder's (i.e., $\delta_B > \delta_T$). In this case, a takeover increases the aggregate internalization of externalities, thereby facilitating takeovers that result in $\phi_1 > 0$.

## 4.4 Takeover cycles

Our analysis above suggests that imbalances in warm-glow social preferences can generate cycles of deal-making: green assets are acquired by brown bidders and subsequently sold back to green bidders, creating excessive takeover activity without corresponding economic benefits. We highlight that takeover cycles of this type are impossible in the standard case without externalities ($\phi_1 = \phi_0 = 0$), since in this case a takeover can only succeed if it raises financial value, $v_1 > v_0$, and this can only occur in one direction.

To see this point most clearly, consider a stylized economy with two types of agents, $L$ and $H$, who alternate roles as bidders and target shareholders across successive takeover rounds. Both types have pure warm-glow preferences: type-$i$ agents place weight $\delta^i$ on externalities when holding shares, and zero weight upon divestment, where $\delta^H > \delta^L \geq 0$. The firm's externality profile is tied to who controls it: the firm generates $\phi^L < 0$ under $L$'s management (brown) and $\phi^H > 0$ under $H$'s management (green). We further assume that

$$\delta^L < \frac{v^L - v^H}{\phi^H - \phi^L} < \delta^H, \tag{22}$$

where $v^H$ and $v^L$ denote the financial values associated with the two management regimes. Under this assumption, both types are worse off under the regime that does not align with their social preferences, implying $s_T^H < 0$ and $s_T^L < 0$.

In every period, the target firm is owned by $N$ shareholders of the same type, and the bidder is drawn from the other type. There are infinitely many investors of each type, and every investor participates in a takeover only once, so there are no dynamic linkages.[19] The only persistence is the firm's externality profile, which flips with successful takeovers.

We refer to a takeover in which a type-$L$ bidder acquires a type–$H$ target as a *brown*

[19]Pure warm-glow preferences also imply that, once investors sell their shares, they no longer care about the firm's subsequent ownership or management.

*transition*. Similarly, a takeover in which a type-$H$ bidder acquires a type-$L$ target is a *green transition*. The next result establishes that the conditions above give rise to takeover cycles, whereby both brown and green transitions of the same asset occur in equilibrium.

**Proposition 2** *There exists an equilibrium in which both the brown transition and the green transition succeed with certainty.*

The result follows directly from Corollaries 2 and 3, applied to each transition in turn. In the brown transition, $H$-shareholders face $s_T^H < 0$ and therefore collectively prefer the takeover to fail, as the increase in financial value is insufficient to compensate for the deterioration in externalities. Yet, because $\delta^H > \delta^L$ and $\phi^L < 0$, Corollary 2 implies that the $L$-bidder can exploit their warm-glow aversion to remaining minority shareholders in a brown-managed firm, yielding an equilibrium in which the takeover succeeds with certainty despite reducing their welfare. Anticipating success, each $H$-shareholder prefers to tender rather than remain a minority owner.

In the green transition, $L$-shareholders likewise face $s_T^L < 0$ and therefore collectively prefer the takeover to fail, as the decline in financial value outweighs the improvement in externalities. Since $\delta^H > \delta^L$ and $\phi^H > 0$, Corollary 3 implies that the type-$H$ bidder internalizes the resulting externality gains more strongly and is therefore willing to offer a higher premium, ensuring takeover success.

## 4.5 Endogenous externalities as a bidding tactic

So far we have taken the takeover's effect on the target as given, by specifying $v_1$ and $\phi_1$ exogenously. What if instead a bidder has some ability to commit to post-takeover policies when making an offer—specifically, to the trade-off between maximizing cash-flows $v_1$ and maximizing broader social value $\phi_1$?

Formally, the bidder faces a technologically determined choice set $\left\{(v_1(\tilde{\phi}_1), \tilde{\phi}_1)\right\}$ of feasible combinations of cash flows and externalities. Define

$$\phi_1^{**} \equiv \arg\max_{\tilde{\phi}_1} v_1(\tilde{\phi}_1) + \alpha_T \tilde{\phi}_1 \tag{23}$$

as the choice that target shareholders would make if they directly controlled the technology.[20]

The following result extends Theorem 1, demonstrating how the choice of externalities can serve as an effective bidding tactic.[21]

**Proposition 3** *Suppose $\delta_B = \alpha_B$. If $\delta_T = \delta_B$, then the bidder chooses $\phi_1^{**}$, and if $\delta_T > \delta_B$ ($\delta_T < \delta_B$), the bidder's choice is smaller (larger) than $\phi_1^{**}$.*

Consistent with intuitions from Corollaries 1-3, under balanced social preferences the bidder pledges the level of externalities that target shareholders directly select for themselves. In contrast, if combined warm-glow preferences are weak ($\delta_T > \delta_B$) the bidder tilts its post-takeover plans towards worse externalities. In particular, the bidder can raise its profits by pledging negative post-takeover externalities $\phi_1 < 0$, for the reasons covered by Corollary 2.

From (15) it follows that if the bidder has ownership invariant social preferences ($\alpha_B - \delta_B > 0$), it has additional incentives to improve the firm's externalities and increase $\phi_1$. Proposition 3 suggests that the bidder may overinvest in improving firm's externalities, both from the perspective of target shareholders and from the perspective of social welfare (21). This may arise, for example, when preferences are balanced ($\delta_T = \delta_B$) and ownership is widely dispersed ($N \to \infty$). Intuitively, the free-rider problem in takeovers limits the bidder's profit from improving firm value. As a result, the bidder under-internalizes these gains relative to the externalities, leading to excessive investment in the externalities at the expense of firm value. The next section further explores the "dark side" of social responsibility.

# 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 of social responsibility. 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.

[20] We assume that the bidder's choice set includes at least one option with negative externalities, $\tilde{\phi}_1 < 0$, that $\phi_1^{**}$ is well-defined, and that $v_1(\cdot)$ is differentiable at $\phi_1^{**}$.

[21] We adopt the mild assumption that if $\phi_1'$ leads to a unique equilibrium where the takeover fails, while $\phi_1''$ generates multiple equilibria with at least one yielding strictly positive bidder payoff, then the bidder prefers $\phi_1''$ to $\phi_1'$.

## 5.1 When social responsibility backfires

The comparison between Corollaries 1 and 2 implies that stronger social responsibility can, under certain conditions, reduce shareholder welfare.

This result can be illustrated as follows. Suppose $\alpha_B = \delta_B = \delta_T$. Corollary 1 predicts that takeovers that reduce shareholder welfare ($s_T < 0$) are blocked, while those that increase it ($s_T > 0$) are likely to succeed. Starting from this baseline, suppose that $\phi_1 < \min\{0, \phi_0\}$ and shareholders' social preferences grow stronger in the sense that $\delta_T$ and $\alpha_T$ increase by the same amount.[22] Corollary 2 then implies that stronger social preferences allow takeovers that reduce shareholder welfare to succeed with higher probability. Conversely, if $\phi_1 > \max\{0, \phi_0\}$, the same corollary implies that heightened social preferences (i.e., increasing $\delta_T$ and $\alpha_T$ by the same amount) impede takeovers that increase shareholder welfare.

In sum, greater social responsibility of target shareholders can, in some instances, lead to worse outcomes from the perspective of shareholder welfare. The underlying intuition is that the alignment of takeover outcomes with shareholder welfare depends not only on the degree to which externalities are internalized, but also on the *balance* of social responsibility between shareholders and the bidder.

As a leading application: public firms' shares are largely held by institutional investors that likely have warm-glow social preferences (i.e., restricted to portfolio firms, $\delta_T = \alpha_T$). At the same time, a growing share of acquisition activity is driven by private equity (PE) firms, which likely have purely financial motivations ($\delta_B = \alpha_B = 0$). Our analysis highlights that this preference configuration easily generates undesirable outcomes, such as PE firms acquiring coal firms for low prices, and sometimes making them dirtier ($\phi_1 < \phi_0$), without necessarily improving financial performance (so that $s_T < 0$). Similarly, in this context our analysis implies that shareholder welfare would improve if institutional investors adopted a consequentialist outlook ($\delta_T = 0$) or if PE firms matched institutional investors' social preferences ($\delta_B = \delta_T$). Even the more modest—and likely more attainable—change of institutional investors switching to a purely financial focus ($\delta_T = \alpha_T = 0$) would improve outcomes in many cases, and in particular prevent the kind of shareholder-welfare-destroying takeovers discussed above.

[22] Since $\phi_1 < \phi_0$, $s_T$ declines with $\alpha_T$. Moreover, such changes are consistent with a higher $\alpha_T - \delta_T$, implying that target shareholders place greater weight on externalities regardless of their ownership position.

## 5.2 Trade with financial investors

A common argument is that the presence of non-social capital in financial markets—such as hedge funds or risk arbitrageurs—dilutes or even nullifies the impact of responsible investment. We show that this argument is incorrect in 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 $\delta = \alpha = 0$). We assume decentralized and frictionless financial markets, with trades occurring whenever they generate mutual gains.[23] 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 is likewise purely financial ($\alpha_B = \delta_B = 0$). We focus the analysis on the effects of pre-takeover trading on social welfare.

**Proposition 4** *Suppose $\alpha_B = \delta_B = 0$. (a) If $\delta_T = 0$ then no trade occurs. If $\delta_T > 0$ then (b) trade weakly enhances social welfare (21) if $v_1 - v_0$, $\phi_1 - \phi_0$, and $\phi_1$ all have the same sign; whereas (c) trade weakly reduces social welfare if $v_1 - v_0$ and $\phi_1 - \phi_0$ have the same sign, but this sign is opposite to that of $\phi_1$.*[24]

Part (a) of Proposition 4 establishes that there are gains from trade between social and financial investors only if social investors have warm-glow preferences ($\delta_T > 0$). Intuitively, if social investors have pure consequentialist preferences ($\delta_T = 0$), then takeover outcomes are sufficiently close to efficiency (Corollary 1) that there is no scope for gains from trade.

Part (b) of Proposition 4 highlights instances in which trades with financial investors can arise in equilibrium, and when they do, they increase social welfare. From Corollary 2, if $\delta_T > 0$, then a takeover that would improve shareholder welfare ($s_T > 0$) and 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 also increases shareholder value ($v_1 > v_0$), then it succeeds with higher probability when the target shares are instead held by financial investors.

[23] 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.

[24] Note that the cases described aren't exhaustive. The proof characterizes the effect of trade on takeover probabilities in all cases.

In this case, whenever trade occurs,[25] it facilitates the takeover, and since the takeover improves both firm value ($v_1 > v_0$) and the firm's externalities ($\phi_1 > \phi_0$), it necessarily enhances social welfare (21).[26]

Part (c) of Proposition 4 covers cases in which trade with financial investors harms social welfare. For example, if a takeover would improve shareholder welfare ($s_T > 0$) 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 also increases shareholder value ($v_1 > v_0$), the holdout problem leads to a lower probability of takeover success; and *a fortiori* a takeover that reduces shareholder value has even less probability of success. Since both $v_1 > v_0$ and $\phi_1 > \phi_0$, social welfare necessarily decreases. Notice that trade occurs in these cases even despite harming social welfare because social investors' warm-glow preferences generate a direct trade surplus to selling shares with negative externalities.

## 5.3 When social investors are in a minority

Our baseline analysis considers the case in which all target shareholders have social preferences; while the proceeding subsection considers the case in which all target shareholders sell to financial investors. The intermediate case in which target shareholder are a heterogeneous mix of shareholders with social preferences and financial shareholders is more complicated, and for the most part a topic for subsequent research. But to give a sense of the kind of effects that can arise, we next discuss the important case of a minority $M < \min\{K, N-K\}$ shareholders having social preferences, while the remainder are financial.

To identify an additional channel through which social responsibility can backfire, we focus on takeovers that create shareholder value ($v_1 > v_0$) while reducing the welfare of socially minded shareholders ($s_T < 0$). To isolate this mechanism from the inefficiencies generated by warm-glow preferences discussed above, we henceforth assume that social shareholders are

[25] Trade occurs whenever the product of the change in shareholder welfare $s_T$ and the change in takeover probability associated with transferring shares from social to financial investors is sufficiently large.

[26] Cases with $v_1 < v_0$, $\phi_1 < \phi_0$, and $\phi_1 < 0$ are analogous: any trade that occurs in this setting enhances social welfare 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.

fully consequentialist ($\delta_T = 0$). We then show that:

**Corollary 4** *The bidder's financial payoff is increasing in the number of social shareholders $M$.*

The economic force behind Corollary 4 is as follows. Because the number of social shareholders $M$ is below the number of shares needed for control $K$, the marginal tendering shareholder is financial. Consequently, in equilibrium the relevant indifference condition is a financial shareholder's, viz.,

$$\Delta (v_1 - v_0) = (q + \Delta) (v_1 - p) , \tag{24}$$

while (a fortiori) a consequentialist social shareholder rejects the bidder's offer. Importantly, the pivotal probability $\Delta$ is calculated using just the population of the $N-M$ financial investors,

$$\Delta = \binom{N-M-1}{K-1} \gamma^{K-1} (1 - \gamma)^{N-M-K} . \tag{25}$$

The bidder's financial payoff is

$$(N - M) \gamma (q + \Delta) (v_1 - p) = (N - M) \gamma \Delta (v_1 - v_0) . \tag{26}$$

Analogous to our baseline analysis, the offer $p$ that maximizes the bidder's financial payoff is the offer than induces the tendering probability $\gamma$ that solves

$$\max_{\gamma} (N - M) \gamma \Delta. \tag{27}$$

Expression (27) shows the two opposing effects of how the size of social block $M$ affects the bidder's financial payoff. On the one hand, if there are more social investors then there are effectively fewer shares available for the bidder to purchase; ceteris paribus, this reduces the bidder's payoff. But on the other hand, if there are more social investors then each financial investor is more likely to be pivotal; this ameliorates the Grossman-Hart freerider problem, and allows the bidder to capture a greater share of $v_1 - v_0$. Perhaps surprisingly, the latter effect is unambiguously dominant, as established in Lemma A-4, thereby establishing Corollary 4.

Corollary 4 establishes another channel via which an increase in social responsibility can backfire. That is: if social investors are a minority, and are unable to directly affect the takeover outcome, then an increase in their number leads financial investors to free-ride less, in turn enabling a bidder to acquire the target for a more attractive price. Greater bidder profits are in turn likely to increase the likelihood of a bidder mounting a value-improving but social-shareholder-welfare-reducing takeover in the first place.

Moreover, a straightforward reinterpretation of Corollary 4 makes precise a cost of expressive preferences (Brennan and Lomasky (1993)). Specifically, suppose that instead of $M$ shareholders with social preferences we have $M$ shareholders who would suffer expressive disutility from tendering their shares. Exactly as above, these expressive-preference shareholders strictly prefer to decline the bidder's equilibrium offer. Under this interpretation, Corollary 4 says that an increase in the number of shareholders with expressive preferences *increases* the bidder's financial preferences from a takeover with $v_1 > v_0$ but $\phi_1 << \phi_0$.

In formal terms, Corollary 4 is closely related to Holmstrom and Nalebuff's (1992) result that increasing the threshold for control $K$ increases bidder profits.[27] Thematically, Corollary 4 overlaps with a contemporaneous paper of Jin and Noe (2026); these authors analyze shareholder voting, and identify circumstances in which an increase in the number of "green" investors prompts "brown" investors to take a vote more seriously, thereby increasing the probability that the vote yields a "brown" outcome.

# 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. For simplicity, throughout we assume a bidder with pure warm-glow preferences ($\delta_B = \alpha_B$).

## 6.1 Equity offers

If the bidding firm is publicly traded it can use its own equity as payment. Unlike a cash offer, an equity offer grants tendering shareholders ownership, thereby exposing them to externalities generated by the combined entity—an effect relevant when shareholders have warm-glow social

[27] Lemma A-4, which is the key step in establishing Corollary 4, is a comparative static in the number of shareholders, $N$; Holmstrom and Nalebuff's Proposition 1 is a comparative static in the number of shares needed for control, $K$.

preferences. We analyze how this effect determines a bidder's preferences over cash versus equity offers, generating novel insights for this choice-of-payment-method question.[28]

Specifically, consider a bidder with stand-alone value $V_B$, externalities $\Phi_B$, and $N_B$ shares outstanding. The bidder offers each tendering target shareholder $e \geq 0$ newly-issued shares in itself, conditional on at least $K$ shareholders tendering. Hence if $j \geq K$ target shareholders tender, the financial value of each share in the post-takeover bidder is $\frac{V_B + jv_1}{N_B + ej}$; notably, this value varies with the number of tendering shareholders. Similarly, the externalities associated with each share in the post-takeover bidder are $\frac{\Phi_B + j\phi_1}{N_B + ej}$.[29] In order to focus on core economic mechanisms we restrict attention to warm-glow shareholder preferences ($\delta_T = \alpha_T$), and so in particular abstract from the question of how much target shareholders internalize the bidder's externalities absent a takeover. We make the mild assumption that all relevant valuations are positive even after accounting for externalities (e.g., $V_B + \alpha_T \Phi_B > 0$ etc.; see formal statement in the appendix). Finally, for conciseness, and for this subsection only, we assume that if multiple stable equilibria exist then the one with the highest tendering probability is played.

**Proposition 5** *Suppose $\delta_T = \alpha_T$. (a) If $\delta_B = \delta_T$ then the bidder is indifferent between cash and equity offers. (b) Otherwise, if $\delta_B < (>) \delta_T$ then the bidder strictly prefers a cash (equity) offer if $\Phi_B + \max\{\kappa\Phi_1, \Phi_1\} < 0$ and strictly prefers an equity (cash) offer if $\Phi_B + \min\{\kappa\Phi_1, \Phi_1\} > 0$.*

Part (a) of Proposition 5 establishes that if preferences are balanced then the payment method is irrelevant: the bidder's payoff (and also tendering probabilities) under the most profitable cash offer matches the payoff under the most profitable equity offer. However, if preferences are imbalanced then the choice of payment method matters.

Part (b) deals with the case in which the bidder cares differently about externalities than do target shareholders. Consider the case $\delta_B < \delta_T$. Recall from Corollary 2 that cash offers in a takeover that results in negative externalities ($\Phi_1 < 0$) benefit from the fact that target shareholders are eager to divest their shares in this case. In contrast, an equity-offer surrenders some of this advantage, since target shareholders who tender still have equity stakes, and hence

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

[29] A successful tender offer does not automatically result in a full merger of the two firms. In such cases, we assume that a post-takeover share in the bidder reflects the target's externalities in proportion to the bidding firm's ownership share in the target.

continue to care about externalities. As Proposition 5 makes clear, the relevant externalities in an equity offer are those of the post-takeover firm, stemming from both the bidder's stand-alone externalities and post-takeover target, and which lie between $\Phi_B + \kappa\Phi_1$ and $\Phi_B + \Phi_1$. Similarly, a bidder benefits from making an equity offer rather than a cash offer if the combined externalities of the post-takeover externality are positive.

Proposition 5 implies that the method of payments in takeovers signals the bidder's social preferences. Specifically, if $\Phi_B < -\min\{\kappa\Phi_1, \Phi_1\}$ then the bidder uses cash offers if $\delta_B < \delta_T$ and equity offers if $\delta_B > \delta_T$. Thus, when an established fossil fuel company (i.e., firms with sufficiently negative $\Phi_B$) acquires an emerging renewable energy firm (with $\Phi_1 > 0$) using equity the primary motivation is likely a desire to reduce environmental impact ($\delta_B > \delta_T$, due to regulatory pressure or shareholder green preferences). Conversely, when it uses cash the primary motivation is likely profit maximization ($\delta_B < \delta_T$).

### 6.2 Leveraged offers

In practice, bidders often finance acquisitions with debt that is 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. The bidder chooses both leverage level $d$ and the offer price $p$ to maximize its payoff, which is given by $N$ times

$$\Lambda d + \gamma (q + \Delta) (v_1 - d - p + \delta_B \phi_1) . \tag{28}$$

The first term is the bidder's expected proceeds from debt issuance;[30] the second term is simply (14), adjusted for the fact that the target is now encumbered with debt. Expression (28) simplifies to

$$(1 - \gamma) qd + \gamma (q + \Delta) (v_1 - p + \delta_B \phi_1) . \tag{29}$$

[30] If the takeover fails then the bidder immediately repays the debt (or equivalently, simply never issues the loan), and in this case debt has no effect on the bidder's payoff.

Legal protections for minority shareholders are typically interpreted to require

$$v_1 - d \geq v_0, \tag{30}$$

a point that we return to below. By requirement (30), leverage is viable only if $v_1 > v_0$.

Leverage generates three significant effects, as detailed in the following result. For conciseness, we state the result for just the case of balanced preferences, which exhibits all three effects; but Online Appendix B fully characterizes equilibrium outcomes for all parameter values.

**Proposition 6** *Suppose $\delta_B = \delta_T$ and $v_1 > v_0$.*

(a) *If $s_T > 0$ and $\phi_1 > \phi_0$, leverage increases the probability of a successful takeover.*

(b) *If $s_T > 0$ and $\phi_1 < \phi_0$, under some conditions, leverage decreases the probability of a successful takeover.*

(c) *If $s_T < 0$, leverage increases the probability of a successful takeover.*

In part (a), leverage increases the success probability of takeovers that enhance shareholder welfare. 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 shares the liability with minority shareholders. Consequently, and consistent with Mueller and Panunzi (2004), leverage allows a bidder to capture a greater share of a takeover's value-creation, mitigating the holdout problem and facilitating the takeover.[31]

In part (a), the condition $\phi_1 > \phi_0$ and the legal protection (30) together rule out "coercive" tender offers in which there is an equilibrium in which a takeover succeeds for sure even though

[31] Online Appendix C characterizes the effect of freeze-out mergers. Absent social externalities, leverage and freeze-out mergers operate broadly similarly as ways for a bidder to capture a greater share of a takeover's value-creation and thereby mitigate the holdout problem. In contrast, with social externalities there are significant differences between the two mechanisms. 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 efficiency's expense. Second, the effectiveness of each mechanism depends critically on the alignment between shareholder value and welfare. When takeovers increase shareholder welfare but reduce shareholder value, legal protections render leveraged offers ineffective while freeze-out mergers remain viable. Conversely, when takeovers reduce shareholder welfare but increase shareholder value, freeze-out mergers are ineffective, which is desirable from shareholders' perspective; while leveraged offers have the negative consequences discussed in the main text. See Proposition IA-1 in Online Appendix C) while leveraged offers retain effectiveness.

shareholders would prefer to coordinate to play the distinct equilibrium in which the takeover fails for sure. If instead, $\phi_1 < \phi_0$, as in part (b), then a second effect of leverage arises. Now, the bidder trades off two alternatives: (i) low leverage ($d \approx s_T$) and a high offer, and a unique equilibrium in the tendering subgame, versus (ii) high leverage ($d = v_1 - v_0 > s_T$) and a low offer, with everyone-retaining and everyone-tendering both equilibria in the tendering subgame. There are parameter values under which the latter strategy dominates, due to the bidder's large profits if the takeover succeeds; but in which the takeover success probability is lower than in the no-leverage baseline.

Finally, part (c) establishes that leverage can increase the success-probability of takeover that reduces shareholder welfare. The ability to take leverage and dilute shareholders enables the bidder to profit in such cases.

The negative consequences of leverage in parts (b) and (c) of Proposition 6 are both consequences of the legal protection (30) failing to account for social externalities. If the legal standard (30) were replaced with the alternative standard

$$d < s_T, \tag{31}$$

then these negative consequence are avoided: this standard prevents both the use of leverage in part (c) and the use of coercive offers in part (b), while still allowing (and indeed enhancing) the role of leverage in part (a). (At the same time, it is important to acknowledge that even in part (a), leverage allows a transfer of surplus from target shareholders to the bidder.)

The attractive properties of legal standard (31) suggest a normative argument for reconsidering the appropriate protections for minority shareholders. It is worth highlighting that replacing legal standard (30) with (31) represents *neither* a uniform strengthening nor a uniform weakening of legal restrictions.

Overlapping with this last point: If $\phi_1 \geq \phi_0$ then the negative consequences of leverage articulated in parts (b) and (c) of Proposition 6 don't arise. Instead, these negative consequences emerge only in cases in which takeovers worsen externalities, $\phi_1 < \phi_0$.

## 6.3 Legal protections for minority shareholders

Proposition 1 and Theorem 1 together establish that takeovers that reduce shareholder value ($v_1 < v_0$) succeed only if either target shareholders or the bidder have social preferences. In many such cases, takeover success requires that shareholders sell their shares for less than the stand-alone financial value $v_0$, either because of positive externalities from the takeover, or because of the fear that the takeover will succeed regardless, leaving any minority shareholders with ownership in a firm with a lower valuation and/or negative externalities ("pressure to tender"). Corollary 1 shows that, under balanced social preferences, takeovers that increase shareholder welfare but reduce shareholder value regularly succeed. However, in such cases minority shareholders who refused to sell for the offered price may be tempted to sue the bidder, seeking compensation for the post-takeover decline in firm value from $v_0$ to $v_1$. Here, we analyze the effect of such post-takeover litigation.

Specifically, suppose that following a successful takeover non-tendering shareholders litigate and demand that the bidder "make them whole" by purchasing their shares at a price equal to the pre-takeover financial value $v_0$.[32] Such litigation occurs if and only if

$$v_0 > v_1 + \delta_T \phi_1. \tag{32}$$

Litigation is successful with probability $\sigma$. Since distortions already arise under imbalanced social preferences, we focus on the case of balanced preferences, $\delta_B = \delta_T$.

**Proposition 7** *Suppose $\delta_B = \delta_T$. If condition (32) holds then $\Lambda^*$ is decreasing in $\sigma$.*

In combination with Corollary 1, Proposition 7 establishes that minority protections that give target shareholders the ability to litigate ex post prevent some takeovers from succeeding, thereby harming shareholder welfare. The possibility of post-takeover litigation makes shareholders more reluctant to tender, reducing the probability of takeover success. And even when a takeover does succeed litigation harms the bidder. The inability of minority shareholders to commit not to sue following a successful takeover represents a further instance of

[32] Relatedly, Hart and Zingales (2017) note that if there is a continuum of shareholders and the legal environment is such that any takeover is followed by a freeze-out merger guaranteeing shareholders at least $v_0$ then some shareholder welfare enhancing takeovers fail. An analogous version of Proposition 7 holds when non-tendering shareholders litigate for a cash payout of $v_0 - v_1$ while retaining their shares(see proof in appendix).

miscoordination—one that ultimately harms shareholder welfare.[33]

A final point is that, as in our discussion of legal standards aimed at protecting target shareholders from leveraged takeovers, the problem here is that the litigation standard (32) fails to incorporate social concerns. An alternative litigation standard under which minority shareholders sue only if $v_0+\alpha_T\phi_0 > v_1+\alpha_T\phi_1$ straightforwardly (weakly) increases shareholder welfare.

## 6.4 Social responsibility as a takeover defense

In this section, we analyze how incumbent management can strategically employ social responsibility as a takeover defense. This question is particularly relevant given recent evidence that firms' adoption of ESG policies responds to changes in their vulnerability to takeover attempts (e.g., Tsang et al. 2024).

Parallel to our discussion in subsection 4.5, the target's incumbent management selects pecuniary value and social externalities from a technologically determined choice set $\left\{(v_0(\tilde{\phi}_0), \tilde{\phi}_0)\right\}$ prior to the bidder making an offer. Define

$$\phi_0^{**} \equiv \arg\max_{\tilde{\phi}_0} \; v_0(\tilde{\phi}_0) + \alpha_T\tilde{\phi}_0 \tag{33}$$

as the choice that maximizes shareholder welfare if the target remains under the incumbent's control. In order to focus on cases in which the incumbent faces the greatest threat of a takeover, we assume that the bidder increases shareholder welfare under all possible choices by the incumbent, $s_T\left(\phi_0^{**}\right) > 0$.

We consider two types of incumbents: a shareholder-oriented incumbent, whose objective is to maximize the welfare of target shareholders, and an entrenched incumbent, whose objective is to retain control by minimizing the likelihood of a successful takeover.

**Corollary 5** *Suppose $s_T\left(\phi_0^{**}\right) > 0$. (a) If $\delta_B = \delta_T$ then both shareholder-oriented and entrenched incumbents pick $\phi_0^{**}$. If instead $\delta_B < \delta_T$ then (b) if $\phi_1 < 0$ then a shareholder-oriented incumbent picks $\phi_0^{**}$ while an entrenched incumbent does not, and (c) if $\phi_1 > 0$ then*

[33] Burkart et al. (2014) find a non-monotonic relationship between legal investor protections and takeover efficiency in a setting without externalities. We complement their analysis by showing that legal standards designed around financial value alone may lead to inefficient outcomes once social externalities are introduced.

*an entrenched incumbent picks* $\phi_0^{**}$ *while a shareholder-oriented incumbent does not.*

Corollary 5 follows directly from our earlier baseline characterization of takeover outcomes, and in particular from the fact that in equilibrium the bidder's per-share payoff is

$$\gamma \Delta s_T (\phi_0) + \gamma (q + \Delta) (\delta_B - \delta_T) \phi_1 \tag{34}$$

while target shareholders are indifferent between retention and tendering, and hence benefit from an increase in their retention (reservation) utility, which is given by

$$v_0 + \alpha_T \phi_0 + q s_T (\phi_0) . \tag{35}$$

Consistent with the rest of our analysis, part (a) shows that balanced preferences lead to good outcomes for shareholder welfare. In this case, the incumbent's choice of $\phi_0$ doesn't affect the takeover's probability; but choices that are better for shareholder welfare raise target shareholders' reservation utility (35), forcing the bidder to improve its offer. The reason that the incumbent's choice of $\phi_0$ doesn't affect the takeover's probability is that, in this case, the bidder's payoff stems entirely from its share of a takeover's contribution to shareholder welfare; and this share is in turn determined by the probability that an individual shareholder is pivotal, which is independent of $s_T (\phi_0)$.

If preferences are imbalanced, however, with $\delta_B < \delta_T$ and the bidder creating negative externalities as in part (b), then the bidder's payoff stems both from a share in the improvement to shareholder welfare and from the utility benefit of warm-glow target shareholders divesting their shares. As (34) highlights, the bidder faces a trade-off between the two sources of profit. An entrenched incumbent can exploit this trade-off to reduce the takeover probability. Specifically, an entrenched incumbent chooses a $\phi_0$ that is suboptimal from the perspective of shareholder welfare, because by doing so it strengthens the extent to which a takeover improves shareholder welfare, thereby inducing the bidder to put more weight on this part of its payoff, which it does by reducing its offer. In this case, social *irresponsibility* acts as a takeover defense, albeit at the expense of shareholder welfare.

In contrast, a shareholder-oriented incumbent cares both about shareholder welfare under the incumbent and raising the takeover's success probability (see (35)). The two objectives are aligned: by picking $\phi_0^{**}$, the incumbent maximizes shareholder welfare under the incumbent; and, by minimizing the additional shareholder welfare created by the takeover, induces the bidder to focus on maximizing takeover success.

# 7 Extensions and discussions

## 7.1 Preferences that scale with $N$

In our description of the model (page 7) we noted circumstances under which shareholders' preferences $\alpha_T$ and $\delta_T$ over per-share externalities $\phi$ scale with the number of shareholders $N$, so that each individual shareholder's utility/disutility from externalities is fixed at $\alpha_T \Phi$ (or $(\alpha_T - \delta_T)\,\Phi$ after divestment) regardless of the number of shareholders. The large majority of our results are stated for a given value of $N$, and as such are unaffected by the scaling behavior of preferences over externalities. But in a few places—most importantly, in our discussion following Theorem 1—we present results for what happens as $N$ grows large under the assumption that the preference parameters $\alpha_T$ and $\delta_T$ are independent of $N$. Here, we revisit these results under the alternative scaling assumption, i.e.,

$$\alpha_T = N\bar{\alpha}_T \text{ and } \delta_T = N\bar{\delta}_T. \tag{36}$$

As the number of shareholders $N$ grows large, each individual shareholder's financial exposure to the target firm shrinks towards zero. In contrast, the preference-scaling assumption (36) means that each individual's exposure to the firm's externalities remains fixed. Consequently, concerns over externalities grow to completely dominate financial concerns.[34]

**Proposition 8** *Suppose the preference parameters $\alpha_T$ and $\delta_T$ scale according to (36):*

[34] Broccardo et al (2022) assume that shareholders' preferences over externalities scale as in (36) in their analysis of firm decisions in the presence of externalities. Moreover, they further assume that each shareholder *also* puts weight on the pecuniary payoffs of over shareholders. Consequently, an individual shareholder's pecuniary payoff becomes negligible as $N$ grows large; but in contrast to Proposition 8, concerns over externalities don't grow to dominate concerns about a firm-decision's impact on a firm's financial health, precisely because each shareholder cares about others' pecuniary payoffs. We have used our framework to analyze takeovers under these preferences. Consistent with Theorem 1 above: in the benchmark case of consequentialist shareholders and financial bidders ($\delta_T = \delta_B = \alpha_B = 0$), for $N$ large (but finite) takeovers succeed if and only if they increase shareholder welfare. But in contrast to Theorem 1 above: the bidder's profits explode, for the same reasons as those discussed shortly below.

(*i*) *If* $\bar{\delta}_T > 0$ *then* $\lim_{N\to\infty} \Lambda^* = 0$ *if* $\phi_1 > 0$*; while if* $\phi_1 < 0$ *there exists an equilibrium sequence with* $\lim_{N\to\infty} \Lambda^* = 1$ *and* $\lim_{N\to\infty} \Pi^* = \infty$.

(*ii*) *If* $\bar{\delta}_T = \delta_B = 0$ *then* $\lim_{N\to\infty} \Lambda^* = 0$ *if* $\phi_1 < \phi_0$*; while if* $\phi_1 > \phi_0$ *then* $\lim_{N\to\infty} \Lambda^* \geq 1/2$ *and* $\lim_{N\to\infty} \Pi^* = \infty$.

In part (i), the bidder's payoff explodes if $\phi_1 < 0$ because of the divestment motive discussed earlier. Specifically, there is an equilibrium in which a *negative* per-share offer of approximately $p \approx \bar{\delta}_T \Phi_1$ is accepted, because each shareholder fears being stuck exposed to negative externalities. If negative offers are infeasible (for example, if negative offers can't be combined with other elements to deliver a positive dollar offer for some bundle) then part (i) still implies that the bidder is potentially able to acquire the target with a per-share offer $p \approx 0$.

Part (ii) of Proposition 8 is perhaps more surprising, especially the part related to the bidder's payoff. Specifically: in part (ii), both the bidder and shareholders are fully consequentialist, and so the divestment effect just discussed is absent. Nonetheless, the bidder is still able to acquire the firm with a negative offer. As discussed immediately prior to Proposition 8, for each shareholder, concerns about externalities dominate financial concerns, as a result of the scaling assumption (36). The surprising aspect of part (ii) is that this effect dominates the standard free-riding problem in public goods provision, whereby each shareholder affects the takeover success probability only by the pivotal probability $\Delta$, which itself approaches 0 as $N$ grows large. The reason is the bidder optimally induces a tendering probability of approximately $\kappa$, so as to narrowly clear the threshold of the number of shares needed for control; and conditional on a tendering probability $\kappa$, the probability that an individual shareholder is pivotal shrinks towards zero at a speed of only $N^{-\frac{1}{2}}$.[35] In words: although the free-riding effect is real, and becomes more severe as $N$ rises, it isn't *that* strong.

[35] Note the relation to the central limit theorem. In formal studies of voting, the observation that the pivotal probability is proportional to $N^{-\frac{1}{2}}$ is often attributed to Penrose (1946). Also in a voting context, Edlin et al (2007) note that if voters are altruistic with preferences similar to (36), then as the number of voters grows large the social importance of the vote grows at a rate fast enough to dominate the decline in the pivotal probability; though Edlin et al (2007) informally argue that the pivotal probability is proportional to $N^{-1}$.

## 7.2 When are takeovers most likely?

Our analysis considers a variety of bidder and target social-preference configurations, naturally raising the question of which are most likely to arise in equilibrium. Since transactions are more likely when takeovers generate higher bidder payoffs, we identify the two circumstances under which bidder payoffs, and consequently the likelihood of a transaction, are greatest.

First, bidder payoffs are highest when the bidder and target shareholders differ substantially in their warm-glow preferences. From Corollaries 2 and 3, this occurs either when $\delta_B < \delta_T$ and the bidder's management generates negative externalities ($\phi_1 < 0$), or when $\delta_B > \delta_T$ and it generates positive externalities ($\phi_1 > 0$). In both cases, differences in warm-glow preferences expand the gains from trade and allow the bidder to capture a larger share of the surplus.

Second, bidder payoffs are also highest when $\phi_1 > \phi_0$ and both the bidder and target shareholders hold strong consequentialist preferences (high $\alpha_B$ and $\alpha_T$). In this case, socially conscious target shareholders are more willing to support the takeover, enabling the bidder to offer a lower premium and retain a larger share of the surplus. At the same time, the bidder derives utility from the acquisition's positive social impact, further increasing the value of the transaction. Thus, unlike warm-glow preferences, consequentialist preferences facilitate takeovers through alignment in social objectives, particularly when the acquisition improves the firm's externalities.

# 8 Conclusion

This paper develops a tractable theoretical framework for studying how social preferences shape takeover outcomes. By introducing externalities and social preferences into the canonical Bagnoli and Lipman (1988) model, we show that social concerns neither mitigate nor exacerbate the classic free-rider problem when bidder and target shareholders hold balanced preferences. When preferences are imbalanced, however, social concerns can have striking and counterintuitive effects. Warm-glow shareholders may facilitate socially harmful takeovers by eagerly divesting from firms that generate negative externalities, while impeding socially beneficial takeovers by holding on to shares in firms that generate positive externalities. Even the case of a consequentialist bidder and target shareholders results in a takeover's effect on externalities dominating all other considerations, including any change in financial value. More broadly, our analysis identifies a balance condition, requiring alignment between the social mandates of the financial sector and the objectives of the corporate sector, as a key determinant of whether the market for corporate control promotes or undermines efficiency.

Beyond this central insight, the framework yields a rich set of implications. Imbalances in warm-glow preferences can generate cycles of deal-making in which assets are repeatedly transferred between owners, producing excessive takeover activity without corresponding economic gains. Perhaps surprisingly, purely financial investors, often criticized for weakening responsible investment, can in some cases improve efficiency by disrupting the socially harmful leg of these cycles. We also show that the method of payment, leverage, legal protections for minority shareholders, and firms' choices of pre- and post-takeover externalities take on new significance once social preferences are incorporated into the analysis, with implications for both deal design and regulatory policy.

In taking a first step toward integrating social preferences into models of corporate control, we deliberately abstract from several important features of real-world takeover markets, including bidder competition, negotiated transactions, information asymmetries, and regulatory intervention. Extending the analysis to incorporate these elements represents a promising direction for future research. So too does empirical investigation of the ownership cycles and sorting patterns across bidder and target social preferences predicted by the model.

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# A Proofs of main results

Throughout the appendix we use the following notation:

$$\hat{v}_1 \equiv v_1 + \delta_T \phi_1. \tag{A-1}$$

The term $\hat{v}_1$ represents the post-takeover value adjusted for the shift in preferences associated with moving a share from a target shareholder to the bidder. We also use the following results on binomial probabilities, the proofs of which are relegated to the Online Appendix, which is available here.

**Lemma A-1** *The following identities hold:*

$$\frac{\partial \Delta}{\partial \gamma} = \left(\frac{K-1}{\gamma} - \frac{N-K}{1-\gamma}\right)\Delta \tag{A-2}$$

$$\frac{\partial q}{\partial \gamma} = \frac{N-K}{1-\gamma}\Delta \tag{A-3}$$

**Lemma A-2** *The ratio $\frac{q}{\Delta}$ strictly increases from $0$ to $\infty$ as $\gamma$ increases from $0$ to $1$.*

**Lemma A-3** *The term $N\gamma\Delta$ evaluated at $\gamma = \kappa$ grows at rate at least $\sqrt{N}$.*

**Lemma A-4** *The term $\max_\gamma N\gamma\Delta$ is decreasing in $N$ (holding $K$ fixed).*

**Proof of Lemma 1.** Suppose the bidder makes a conditional tender offer $p$. Rearranging (8), and given the definition of $s$ and $\hat{v}_1$, we can write

$$\tau(\gamma; p) = (p - \hat{v}_1 + s_T)(q + \Delta) - s_T q. \tag{A-4}$$

Lemma A-1 implies

$$\frac{\partial \tau(\gamma; p)}{\partial \gamma} = \left[(p - \hat{v}_1 + s_T)\frac{K-1}{\gamma} - s_T \frac{N-K}{1-\gamma}\right]\Delta. \tag{A-5}$$

Note that

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

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 (A-5), the shape of $\tau$ is determined by the following four cases:

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

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

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

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

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

$$\hat{\gamma}(p) \equiv \frac{1}{1 + \frac{s_T}{p - \hat{v}_1 + s_T} \frac{N-K}{K-1}}. \tag{A-6}$$

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 $s_T > 0$ then $p > \hat{v}_1 - s_T$.

$\gamma^* \in (0,1)$ is a equilibrium if and only if both case (i) holds and $p < \hat{v}_1$. In this case, $\gamma^*$ 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 $p = \hat{v}_1 - s_T$ and $s_T > 0$ then $p < \hat{v}_1$, and $\gamma^* = 1$ isn't an equilibrium. Similarly, if $p = \hat{v}_1$ and $s_T > 0$ then $p > \hat{v}_1 - s_T$ and $\gamma^* = 0$ isn't an equilibrium. Hence $\gamma^* = 0$ and $\gamma^* = 1$ coexist as equilibria if and only if $p \in (\hat{v}_1, \hat{v}_1 - s_T)$.

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

**Proof of Theorem 1.** Define $\hat{\delta} \equiv (\delta_T - \delta_B)\phi_1$.

*Part (i), $s_T < 0$.* Lemma 1 implies that $\gamma^*$ is given by (10). From (17), $\Pi(0; p) = N(\alpha_B - \delta_B)\phi_0$ and $\Pi(1; p) = N(v_1 - p + \alpha_B \phi_1)$. Hence if $v_1 - \hat{v}_1 + \alpha_B \phi_1 \leq (\alpha_B - \delta_B)\phi_0 \Leftrightarrow \beta \leq \hat{\delta}$, then the bidder's payoff is strictly smaller than $N(\alpha_B - \delta_B)\phi_0$ in any equilibrium with $\gamma^* = 1$. In this case, $\gamma^* = 0$ is the unique equilibrium. Conversely, if $\hat{\delta} < \beta$ then for any $p \in (\hat{v}_1, \hat{v}_1 - s_T]$ there is an equilibrium in which the bidder offers $p$ and $\gamma^* = 1$. The bid $p = \hat{v}_1 - s_T$ guarantees both $\gamma^* = 1$ and a payoff higher than $N(\alpha_B - \delta_B)\phi_0$ for the bidder if $v_1 - (\hat{v}_1 - s_T) + \alpha_B \phi_1 > (\alpha_B - \delta_B)\phi_0 \Leftrightarrow s_T + \beta > \hat{\delta}$. Hence an equilibrium with $\gamma^* = 0$ exists if and only if $s_T + \beta \leq \hat{\delta}$.

*Part (ii), $s_T > 0$.* Lemma 1 implies that $\gamma^*$ is given by (12). Offers in $(\hat{v}_1 - s_T, \hat{v}_1)$ deliver shareholder acceptance probabilities $\gamma$ satisfying $\mu(\gamma) = p$. As $p$ increases over the interval $(\hat{v}_1 - s_T, \hat{v}_1)$, the shareholder acceptance probability $\gamma$ increases continuously from 0 to 1.

From (15), the bidder is effectively choosing $\gamma \in [0,1]$ (via choice of offer $p$) to maximize

$$\pi(\gamma) \equiv \gamma\Delta s_T + \Lambda\beta - (\gamma q + \gamma\Delta)\hat{\delta}. \tag{A-7}$$

From Lemma A-1

$$\frac{\partial(\gamma\Delta)}{\partial\gamma} = \frac{\kappa-\gamma}{1-\gamma}N\Delta; \quad \frac{\partial\Lambda}{\partial\gamma} = N\Delta; \quad \frac{\partial(\gamma q + \gamma\Delta)}{\partial\gamma} = q + \kappa N\Delta. \tag{A-8}$$

Hence

$$\frac{\pi'(\gamma)}{N\Delta} = \frac{\kappa-\gamma}{1-\gamma}s_T + \beta - \left(\frac{q}{N\Delta} + \kappa\right)\hat{\delta}. \tag{A-9}$$

First, consider the case $\hat{\delta} = 0$. In this case (A-9) is strictly decreasing in $\gamma$. Hence if $\kappa s_T + \beta \leq 0$ then (A-9) is strictly negative for all $\gamma > 0$ and $\gamma^* = 0$; while otherwise equating (A-9) to zero yields $\gamma^* = \frac{\kappa s_T+\beta}{s_T+\beta} = \kappa + \frac{(1-\kappa)s_T}{s_T+\beta}$. This establishes (18) for the case $\hat{\delta} = 0$. The limit success probability $\Lambda^*$ is then immediate, establishing (19).

Second, consider $\hat{\delta} > 0$. From (A-9): if $\kappa s_T + \beta \leq 0$ then $\pi'(\gamma) < 0$ for all $\gamma$ and so $\gamma^* = 0$; while otherwise $\pi'(\gamma) < 0$ for all $\gamma \geq \frac{\kappa s_T+\beta}{s_T+\beta}$ and $\gamma^* < \frac{\kappa s_T+\beta}{s_T+\beta}$. This establishes (18) for the case $\hat{\delta} > 0$.

Third, consider $\hat{\delta} < 0$. If $\kappa s_T + \beta \leq 0$ then (19) holds trivially. If instead $\kappa s_T + \beta > 0$ then (A-9) implies $\pi'(\gamma) > 0$ for all $\gamma \leq \frac{\kappa s_T+\beta}{s_T+\beta}$ and so $\gamma^* > \frac{\kappa s_T+\beta}{s_T+\beta}$, establishing (18) for the case $\hat{\delta} < 0$.

*Part (iii), establishing* (19) *and* (20). The result is immediate if $\hat{\delta} = 0$. Here, we consider $\hat{\delta} \neq 0$. First, consider the case $\beta > \min\{\kappa\hat{\delta}, \hat{\delta}\}$, i.e., $\beta > \kappa\hat{\delta}$ or $\beta > \hat{\delta}$. Suppose that, contrary to the claimed result, $\lim \Lambda^* \neq 1$. So there exists a subsequence such that $\lim \Lambda^*$ and $\lim \gamma^*$ both exist, and $\lim \gamma^* \leq \kappa$. Moreover: either $\lim \gamma^* = \kappa$, $\lim \Lambda^* < 1$, and $\lim \pi(\gamma^*) = \lim \Lambda^* \cdot (\beta - \kappa\hat{\delta})$; or $\lim \gamma^* < \kappa$, $\lim \Lambda^* = 0$, and $\lim \pi(\gamma^*) = 0$. For any $\epsilon \in (0, 1-\kappa]$, the bidder can make a sequence of offers inducing $\tilde{\gamma} = \kappa + \epsilon$, yielding $\lim \tilde{\Lambda} = 1$ and a payoff $\lim \pi(\tilde{\gamma}) = \beta - (\kappa+\epsilon)\hat{\delta}$. If $\beta > \kappa\hat{\delta}$ then choose $\epsilon$ small enough that $\beta - (\kappa+\epsilon)\hat{\delta} > \Lambda^* \cdot (\beta - \kappa\hat{\delta})$; while if $\beta \leq \kappa\hat{\delta}$ and $\beta > \hat{\delta}$ then choose $\kappa + \epsilon = 1$. In either case, $\lim \pi(\tilde{\gamma}) > \lim \pi(\gamma^*)$, establishing a contradiction.

Second, consider the case $\beta < \min\{\kappa\hat{\delta}, \hat{\delta}\}$, i.e., $\beta < \kappa\hat{\delta}$ and $\beta < \hat{\delta}$. Suppose that, contrary to the claimed result, $\lim \Lambda^* \neq 0$. So there exists a subsequence such that $\lim \Lambda^*$ and $\lim \gamma^*$ both exist, and $\lim \gamma^* \geq \kappa$. Since $\beta - \kappa\hat{\delta}$ and $\beta - \hat{\delta}$ are both negative, linearity implies that $\beta - \lim \gamma^* \cdot \hat{\delta} < 0$. Hence $\lim \pi(\gamma^*) = \lim \Lambda^* \cdot (\beta - \lim \gamma^* \cdot \hat{\delta}) < 0$. This contradicts the equilibrium condition since $\pi(0) \equiv 0$, and so the bidder can obtain a strictly higher payoff.

Finally, we establish (20). If $\beta \neq \min\{\kappa\hat{\delta}, \hat{\delta}\}$ then this identity follows straightforwardly. If instead $\beta = \min\{\kappa\hat{\delta}, \hat{\delta}\}$, it follows from the fact that for any $\gamma$,

$$\lim_{N\to\infty} \pi(\gamma) = \lim \Lambda \cdot (\min\{\kappa\hat{\delta}, \hat{\delta}\} - \lim \gamma \cdot \hat{\delta}). \tag{A-10}$$

If $\hat{\delta} \leq 0$ then this expression is weakly negative, establishing the result. If instead $\hat{\delta} > 0$ then either $\lim \gamma < \kappa$ and the expression is 0, or $\lim \gamma \geq \kappa$ and the expression is weakly negative. ■

**Proof of Proposition 2.** By assumption, $(\delta^i - \delta^j)\phi^i > 0$ for $j \neq i$, where $i, j \in \{L, H\}$, and under pure warm-glow preferences, $\beta^i = 0$ for all $i \in \{L, H\}$. Suppose the target is populated by type-$i$ investors and the bidder by type-$j$ investors, with $j \neq i$. Then, by Theorem 1 part (i), if $s_T^i < 0$, there exists an equilibrium in which $\Lambda^* = 1$, as required. ■

**Proof of Proposition 3.** Suppose $\delta_B = \alpha_B$. Let $\phi_1^*$ be the externality level chosen by the bidder in equilibrium. If $\delta_B = \delta_T$ then by Corollary 1, if the bidder chooses $\phi_1$ such that $s_T(\phi_1) < 0$ then the bidder's payoff is 0. If instead the bidder chooses $\phi_1$ such that $s_T(\phi_1) > 0$ then the bidder's per-shareholder payoff is $\kappa\Delta(\kappa)\, s_T(\phi_1)$. Hence the bidder chooses $\phi_1 = \phi_1^{**}$. If $s_T(\phi_1^{**}) < 0$ then choosing $\phi_1^{**}$ is weakly optimal.

Next consider the case $\delta_T > \delta_B$ (the case $\delta_T < \delta_B$ follows from parallel arguments). From Theorem 1, if the bidder pledges $\phi_1^{**}$ and $s_T(\phi_1^{**}) > 0$ then shareholders tender with probability $\gamma^{**} \in [0, 1)$, and the bidder's per-shareholder payoff is (writing $\Delta^{**} = \Delta(\gamma^{**})$ and $q^{**} = q(\gamma^{**})$)

$$\gamma^{**}\Delta^{**} s_T(\phi_1^{**}) + \gamma^{**}(q^{**} + \Delta^{**})(\delta_B - \delta_T)\,\phi_1^{**}.$$

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 $\frac{\partial s_T(\phi_1)}{\partial \phi_1}|_{\phi_1^{**}} = 0$, one can find a $\phi_1$ marginally below $\phi_1^{**}$ such that, holding the acceptance probability unchanged at $\gamma^{**}$ (by adjusting the offer $p$), the bidder's payoff is strictly higher. If instead $\gamma^{**} = 0$ then the bidder's payoff from $\phi_1^{**}$ is zero; moreover, by (17) a necessary condition for this case is $\phi_1^{**} > 0$. If the bidder instead chooses $\phi_1 < 0$, then either $s_T(\phi_1) > 0$ and from (17) the bidder's maximized payoff is strictly positive; or else $s_T(\phi_1) < 0$, and if the bidder offers $p$ just above $v_1 + \delta_T\phi_1$ there is an equilibrium of the tendering subgame in which shareholders accept the offer with probability 1 and the bidder's payoff is strictly positive.

If $s_T(\phi_1^{**}) < 0$ then, as noted above, the bidder can offer $p$ just above $v_1 + \delta_T\phi_1$ and make a profit of $(\delta_B - \delta_T)\phi_1$. Thus, choosing the smallest $\phi_1 < 0$ in the choice set, and in particular $\phi_1 < \phi_1^{**}$, is optimal.

Conversely, suppose $s_T(\phi_1^{**}) > 0$ and consider any pledge $\tilde{\phi}_1 > \phi_1^{**}$, with $\tilde{v}_1 = v(\tilde{\phi}_1)$. If this pledge yields a zero payoff for the bidder then it is dominated by $\phi_1^*$ above. Otherwise, let $\tilde{\gamma}, \tilde{\Delta}, \tilde{q}$ be the associated probabilities. From Lemma 1, a necessary condition for $\tilde{\gamma} > 0$ is that the bidder's offer is at least $\tilde{v}_1 + \delta_T \tilde{\phi}_1$. From (15) it follows that, regardless of whether $\tilde{\gamma} \in (0,1)$ or $\tilde{\gamma} = 1$, the bidder's per-shareholder payoff is bounded above by

$$\begin{aligned} & \tilde{\gamma}\tilde{\Delta} s_T(\tilde{\phi}_1) + \tilde{\gamma}(\tilde{q} + \tilde{\Delta})\,(\delta_B - \delta_T)\,\tilde{\phi}_1 \\ < \; & \tilde{\gamma}\tilde{\Delta} s_T(\phi_1^{**}) + \tilde{\gamma}(\tilde{q} + \tilde{\Delta})\,(\delta_B - \delta_T)\,\phi_1^{**} \\ \leq \; & \gamma^{**}\Delta^{**} s_T(\phi_1^{**}) + \gamma^{**}\,(q^{**} + \Delta^{**})\,(\delta_B - \delta_T)\,\phi_1^{**}, \end{aligned}$$

so that $\tilde{\phi}_1$ is dominated by $\phi_1^{**}$, which is in turn dominated by $\phi_1^{*}$ (the first inequality follows from the fact that $\phi_1^{**}$ maximizes $s_T(\phi_1)$ and $\phi_1^{**} < \tilde{\phi}_1$, while the second inequality follows because, by definition, $\gamma^{**}$ maximizes the bidder's payoff given the choice $\phi_1^{**}$.) ■

**Proof of Proposition 4.** The proof repeatedly uses the equilibrium characterization of Theorem 1. 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 $\Lambda_s$ and $\Lambda_f$ be the takeover-success probabilities if shares are held by social and financial investors, respectively. Hence

$$\begin{aligned} u_{ss} &= v_0 + \alpha_T \phi_0 + \Lambda_s s_T \\ u_{sf} &= (\alpha_T - \delta_T)\,\phi_0 + \Lambda_f\,(\alpha_T - \delta_T)\,(\phi_1 - \phi_0) \\ u_f &= v_0 + \Lambda_f\,(v_1 - v_0)\,. \end{aligned}$$

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

$$\begin{aligned} u_{sf} + u_f - u_{ss} &= \Lambda_f\,(v_1 - v_0 + (\alpha_T - \delta_T)\,(\phi_1 - \phi_0)) - \delta_T\phi_0 - \Lambda_s s_T \\ &= \Lambda_f s_T - \Lambda_f \delta_T \phi_1 - (1 - \Lambda_f)\,\delta_T \phi_0 - \Lambda_s s_T. \end{aligned}$$

Hence the trade surplus is positive if

$$(\Lambda_f - \Lambda_s)\,s_T > \delta_T\,(\Lambda_f \phi_1 + (1 - \Lambda_f)\,\phi_0)\,. \tag{A-11}$$

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 $\delta_T = 0$. Specifically, we show that the trade surplus is weakly negative for all combinations of $v_0, v_1, \phi_0$ and $\phi_1$. If $v_1 < v_0$ and $s_T < 0$ then $\Lambda_s = \Lambda_f = 0$. If $v_1 > v_0$ and $s_T < 0$ then $\Lambda_s = 0 < \Lambda_f$. If $v_1 < v_0$ and $s_T > 0$ then $\Lambda_s > 0 = \Lambda_f$. If $v_1 > v_0$ and $s_T > 0$ then $\Lambda_s = \Lambda_f > 0$. So in all cases, the LHS of (A-11) is either zero or negative, while the RHS of (A-11) is simply 0.

Next, consider the case of warm-glow preferences, $\delta_T > 0$:

- Case, $\phi_1 < 0$, $v_1 < v_0$ and $s_T > 0$: $\Lambda_s > \Lambda_f = 0$. Note that $\phi_1 > \phi_0$. The trade condition holds for some parameters (e.g., $\phi_0$ sufficiently negative). Because $v_1 - v_0$ and $\phi_1 - \phi_0$ have opposite signs, the effect on social welfare (21) depends on relative magnitudes.

- Case, $\phi_1 < 0$, $v_1 > v_0$ and $s_T > 0$: $\Lambda_s > \Lambda_f > 0$. The trade condition holds for some parameters (e.g., $\phi_0$ sufficiently negative). If $\phi_1 > \phi_0$ then if trade occurs it harms social welfare, as in part (c).

- Case, $\phi_1 > 0$, $v_1 < v_0$ and $s_T > 0$: $\Lambda_s > \Lambda_f = 0$. Note that $\phi_1 > \phi_0$. The trade condition holds for some parameters (e.g., $\phi_0$ sufficiently negative). Because $v_1 - v_0$ and $\phi_1 - \phi_0$ have opposite signs, the effect on social welfare (21) depends on relative magnitudes.

- Case, $\phi_1 > 0$, $v_1 > v_0$ and $s_T > 0$: $\Lambda_s < \Lambda_f$. The trade condition holds for some parameters (e.g., $\phi_0$ sufficiently negative). If $\phi_1 > \phi_0$ then if trade occurs it enhances social welfare, as in part (b).

- Case, $\phi_1 < 0$, $v_1 < v_0$ and $s_T < 0$: $\Lambda_f = 0$. $\Lambda_s = 1$ is an equilibrium; and $\Lambda_s = 0$ is an equilibrium if $s_T$ 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., $\phi_0$ sufficiently negative); and when trade occurs it enhances social welfare if $\phi_1 < \phi_0$, as in part (b).

- Case, $\phi_1 < 0$, $v_1 > v_0$ and $s_T < 0$: $\Lambda_f \in (0, 1)$. Note that $\phi_1 < \phi_0$. $\Lambda_s = 1$ is an equilibrium; and $\Lambda_s = 0$ is an equilibrium if $s_T$ is sufficiently negative. If $\Lambda_s = 0$ then the trade condition holds for some parameters.[36] Similarly, if $\Lambda_s = 1$ then the trade condition holds for some parameters. Because $v_1 - v_0$ and $\phi_1 - \phi_0$ have opposite signs, effects on social welfare (21) depend on relative magnitudes.

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

- Case, $\phi_1 > 0$, $v_1 < v_0$ and $s_T < 0$: $\Lambda_s = \Lambda_f = 0$. Trade (if it occurs) has no impact on social efficiency.
- Case, $\phi_1 > 0$, $v_1 > v_0$ and $s_T < 0$: $\Lambda_s = 0 < \Lambda_f$. Note that $\phi_1 < \phi_0$. The trade condition holds for some parameters (e.g., $\phi_0$ sufficiently negative). Because $v_1 - v_0$ and $\phi_1 - \phi_0$ have opposite signs, the effect on social welfare (21) depends on relative magnitudes.

■

**Proof of Proposition 5.** Let $v_B \equiv \frac{V_B}{N_B}$ and $\phi_B \equiv \frac{\Phi_B}{N_B}$. Recall that we assume $\delta_T = \alpha_T$ and that all relevant valuations are positive even after accounting for externalities:

$$\begin{aligned} V_0 + \delta_T \Phi_0 &> 0 && \text{(A-12)} \\ V_B + \delta_T \Phi_B + \min\{0, \kappa(V_1 + \delta_T \Phi_1), V_1 + \delta_T \Phi_1\} &> 0 && \text{(A-13)} \\ V_1 + \delta_T \Phi_1 &> 0. && \text{(A-14)} \end{aligned}$$

That is, the target has a positive market value (inequality (A-12)) and the bidder has a positive market value both pre- and post-takeover (inequality (A-13)). Inequality (A-14) is marginally stronger, and is imposed only to avoid the degenerate case in which the bidder is indifferent between cash and equity offers because in both cases it acquires the target at zero cost.[37]

Also, let $\Gamma_{j,N}(\gamma) \equiv \binom{N}{j}\gamma^j(1-\gamma)^{N-j}$, with the convention that $\Gamma_{j,N} \equiv 0$ if $j > N$. To ease exposition, we omit $\gamma$ whenever possible. For use below note that

$$\begin{aligned} \Gamma_{j,N} &= \gamma \Gamma_{j-1,N-1} + (1-\gamma)\Gamma_{j,N-1} && \text{(A-15)} \\ (j+1)\Gamma_{j+1,N} &= N\gamma\Gamma_{j,N-1}. && \text{(A-16)} \end{aligned}$$

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

$$\begin{aligned} & \sum_{j=0}^{K-1} \Gamma_{j,N-1}(v_0 + \delta_T \phi_0) + \sum_{j=K}^{N-1} \Gamma_{j,N-1}(v_1 + \delta_T \phi_1) \\ = & \sum_{j=0}^{K-2} \Gamma_{j,N-1}(v_0 + \delta_T \phi_0) + \sum_{j=K-1}^{N-1} \Gamma_{j,N-1}(v_1 + \delta_T \phi_1) - \Gamma_{K-1,N-1} s_T, \end{aligned}$$

[37]The case $V_1 + \delta_T \Phi_1 \leq 0$ is relevant if $V_1 + \delta_B \Phi_1 > 0$. In this case, then for both cash and equity offers there is an equilibrium in which shareholders accept a coercive offer that is infinitesimally small, yielding the bidder the full payoff $V_1 + \delta_B \Phi_1$ in both cases. (If instead $V_1 + \delta_B \Phi_1 \leq 0$ then the takeover always fails, for the simple reason that the bidder loses from acquiring the target even at a price of zero.)

while the expected payoff from tendering is

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

Hence, the net benefit from tendering is

$$\begin{aligned} \tau_{eq}(\gamma; e) &\equiv \Gamma_{K-1,N-1} s_T + \sum_{j=K-1}^{N-1} \Gamma_{j,N-1} \left( e \frac{N_B \big(v_B + \delta_T \phi_B\big) + (j+1)\big(v_1 + \delta_T \phi_1\big)}{N_B + e(j+1)} - \big(v_1 + \delta_T \phi_1\big) \right) \\ &= \Gamma_{K-1,N-1} s_T + \sum_{j=K-1}^{N-1} \Gamma_{j,N-1} \frac{N_B \big(v_B + \delta_T \phi_B\big)}{N_B + e(j+1)} \left( e - \frac{v_1 + \delta_T \phi_1}{v_B + \delta_T \phi_B} \right). \end{aligned} \quad \text{(A-17)}$$

Observe that $\tau_{eq}(\gamma; e)$ is strictly increasing in $e$ for any $\gamma > 0$.

If $s_T > 0$ then for any $\gamma \in (0,1)$ there exists an offer $e < \frac{v_1 + \delta_T \phi_1}{v_B + \delta_T \phi_B}$ such that $\tau_{eq}(\gamma; e) = 0$; this follows from the fact that $\tau_{eq}(\gamma; 0) < 0 < \tau_{eq}\left(\gamma; \frac{v_1 + \delta_T \phi_1}{v_B + \delta_T \phi_B}\right)$. Moreover, if $e = \frac{v_1 + \delta_T \phi_1}{v_B + \delta_T \phi_B}$ then $\tau_{eq}(1; e) = 0$ and $\gamma = 1$ is the unique stable tendering probability in the subgame.

If instead $s_T < 0$ then if $e \leq \frac{v_1 + \delta_T \phi_1}{v_B + \delta_T \phi_B}$ the unique stable tendering probability is $\gamma = 0$; while if $e > \frac{v_1 + \delta_T \phi_1}{v_B + \delta_T \phi_B}$ then $\gamma = 1$ is a stable tendering probability.

The bidder's payoff (net of status quo) is

$$\begin{aligned} \Pi_{eq}(\gamma; e) \equiv \gamma &\sum_{j=K-1}^{N-1} \Gamma_{j,N-1} \left( N_B \frac{N_B \big(v_B + \delta_B \phi_B\big) + (j+1)\big(v_1 + \delta_B \phi_1\big)}{N_B + e(j+1)} - N_B \big(v_B + \delta_B \phi_B\big) \right) \\ &+ (1-\gamma) \sum_{j=K}^{N-1} \Gamma_{j,N-1} \left( N_B \frac{N_B \big(v_B + \delta_B \phi_B\big) + j\big(v_1 + \delta_B \phi_1\big)}{N_B + ej} - N_B \big(v_B + \delta_B \phi_B\big) \right) \end{aligned} \quad \text{(A-18)}$$

$$\begin{aligned} &= \gamma \sum_{j=K-1}^{N-1} \Gamma_{j,N-1} \frac{N_B (j+1) \big(v_B + \delta_B \phi_B\big)}{N_B + e(j+1)} \left( \frac{v_1 + \delta_B \phi_1}{v_B + \delta_B \phi_B} - e \right) \\ &\quad + (1-\gamma) \sum_{j=K-1}^{N-2} \Gamma_{j+1,N-1} \frac{N_B (j+1) \big(v_B + \delta_B \phi_B\big)}{N_B + e(j+1)} \left( \frac{v_1 + \delta_B \phi_1}{v_B + \delta_B \phi_B} - e \right). \end{aligned} \quad \text{(A-19)}$$

For use below, we establish:

*Claim:* If $\Pi_{eq}(\gamma; e) > 0$ then $\frac{\partial}{\partial \gamma} \Pi_{eq}(\gamma; e) > 0$.

*Proof of Claim:* The condition $\Pi_{eq}(\gamma; e) > 0$ implies $(v_B + \delta_B \phi_B) \left( \frac{v_1 + \delta_B \phi_1}{v_B + \delta_B \phi_B} - e \right) > 0$; this can be seen from (A-19). It then further follows that

$$\frac{N_B(j+1)(v_B+\delta_B\phi_B)}{N_B+e(j+1)}\left(\frac{v_1+\delta_B\phi_1}{v_B+\delta_B\phi_B}-e\right)>\frac{N_Bj(v_B+\delta_B\phi_B)}{N_B+ej}\left(\frac{v_1+\delta_B\phi_1}{v_B+\delta_B\phi_B}-e\right). \quad \text{(A-20)}$$

Inequality (A-20) in turn implies that the first summation in (A-18) exceeds the second summation. Moreover, an increase in $\gamma$ induces a first-order stochastic dominance shift in the distribution of $j$; consequently, (A-20) also implies that each of the two summations in (A-18) is increasing in $\gamma$. The claim then follows from the combination of these two observations.

From (A-15) and (A-16), $\gamma\Gamma_{j,N-1}(j+1)+(1-\gamma)\Gamma_{j+1,N-1}(j+1)=N\gamma\Gamma_{j,N-1}$, and so

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

If $s_T>0$ then in equilibrium $\tau_{eq}(\gamma;e)=0$; using (A-17) it follows that

$$\Pi_{eq}(\gamma;e)=N\gamma\Gamma_{K-1,N-1}s_T+(\delta_B-\delta_T)N\gamma\sum_{j=K-1}^{N-1}\Gamma_{j,N-1}\frac{N_B}{N_B+e(j+1)}(\phi_1-e\phi_B). \quad \text{(A-21)}$$

If instead $s_T<0$ then an equity offer infinitesimally above $e=\frac{v_1+\delta_T\phi_1}{v_B+\delta_T\phi_B}$ leads all shareholders to tender, and delivers a bidder payoff infinitesimally below

$$\begin{aligned} N_B\frac{V_B+\delta_B\Phi_B+V_1+\delta_B\Phi_1}{N_B+N\frac{v_1+\delta_T\phi_1}{v_B+\delta_T\phi_B}}-(V_B+\delta_B\Phi_B) &= \frac{(V_B+\delta_T\Phi_B)(V_1+\delta_B\Phi_1)-(V_1+\delta_T\Phi_1)(V_B+\delta_B\Phi_B)}{V_B+\delta_T\Phi_B+V_1+\delta_T\Phi_1} \\ &= (\delta_B-\delta_T)\frac{V_B\Phi_1-V_1\Phi_B}{V_B+\delta_T\Phi_B+V_1+\delta_T\Phi_1}. \quad \text{(A-22)} \end{aligned}$$

Recall that if $s_T>0$ then the bidder's payoff from a cash offer is (see (17), recalling the definitions of $q$ and $\Delta$)

$$\Pi(\gamma)=N\gamma\Gamma_{K-1,N-1}s_T+(\delta_B-\delta_T)N\gamma\sum_{j=K-1}^{N-1}\Gamma_{j,N-1}\phi_1. \quad \text{(A-23)}$$

If instead $s_T<0$ then a cash offer infinitesimally above $p=v_1+\delta_T\phi_1$ leads all shareholders to tender, and hence the bidder can approach the payoff

$$(\delta_B-\delta_T)\Phi_1. \quad \text{(A-24)}$$

*Part (a), $\delta_B = \delta_T$:* If $s_T \leq 0$ then from (A-22) and (A-24) the bidder's payoff is zero under both equity and cash offers. If instead $s_T > 0$, then recall that the bidder makes a cash offer that induces $\gamma = \kappa$. From (A-21) and (A-23), it is immediate that the bidder cannot do better with an equity offer than with a cash offer. It remains to establish that there is an equity offer that matches the bidder's payoff from the best cash offer. Let $e_\kappa < \frac{v_1+\delta_T\phi_1}{v_B+\delta_T\phi_B}$ be the equity offer such that $\tau_{eq}(\kappa; e_\kappa) = 0$. Observe that there cannot exist $\gamma > \kappa$ such that $\tau_{eq}(\gamma; e_\kappa) = 0$, because by the Claim above, the bidder's payoff would be strictly higher at this $\gamma$, but by (A-21) and the fact that $\gamma\Gamma_{K-1,N-1}$ is maximized at $\kappa$ the bidder's payoff would be strictly lower, a contradiction. It then follows from $\tau_{eq}(1; e_\kappa) < 0$ that $\gamma = \kappa$ is the highest stable subgame equilibrium under offer $e_\kappa$, thereby establishing bidder indifference.

*Part (b), $\delta_B < \delta_T$:* We first consider the case of $s_T > 0$. Since any tendering probability can be induced as a stable equilibrium under a cash offer, from (A-21) and (A-23) a sufficient condition for the bidder to strictly prefer cash to equity is that

$$\phi_1 < \frac{N_B}{N_B + e(j+1)}(\phi_1 - e\phi_B) \text{ for all } j = K-1, \ldots, N-1$$

or equivalently,

$$\max\{\Phi_B + \kappa\Phi_1, \Phi_B + \Phi_1\} < 0.$$

Similarly, we next show that a sufficient condition for the bidder to strictly prefer equity to cash is

$$\min\{\Phi_B + \kappa\Phi_1, \Phi_B + \Phi_1\} > 0. \tag{A-25}$$

To see this, let $\gamma_{ca}$ be the tendering probability under the bidder's payoff-maximizing cash offer. Let $e_{ca} \leq \frac{v_1+\delta_T\phi_1}{v_B+\delta_T\phi_B}$ be the equity offer that induces tendering probability $\gamma_{ca}$. From (A-21), (A-23) and (A-25) it follows that $\Pi_{eq}(\gamma_{ca}; e_{ca}) > \Pi(\gamma_{ca})$. If $\gamma_{ca}$ is the largest stable subgame equilibrium under offer $e_{ca}$ then the result follows. If instead $\gamma_{ca}$ is not the largest stable equilibrium or it is unstable then the fact that[38] $e_{ca} < \frac{v_1+\delta_T\phi_1}{v_B+\delta_T\phi_B}$ implies $\tau_{eq}(1; e_{ca}) < 0$, and hence there must exist a stable subgame equilibrium $\tilde{\gamma} > \gamma_{ca}$. By the Claim, $\Pi_{eq}(\tilde{\gamma}; e_{ca}) > \Pi_{eq}(\gamma_{ca}; e_{ca})$, and hence $\Pi_{eq}(\tilde{\gamma}; e_{ca}) > \Pi(\gamma_{ca})$, establishing the result for $s_T > 0$.

Second, we consider the case of $s_T < 0$. From (A-22) and (A-24) cash offers dominate equity offers if and only if

$$\Phi_1(V_B + \delta_T\Phi_B + V_1 + \delta_T\Phi_1) - (V_B\Phi_1 - V_1\Phi_B) = (\Phi_1 + \Phi_B)(V_1 + \delta_T\Phi_1) < 0,$$

thereby establishing the result for the case $\delta_B < \delta_T$.

[38] If $e_{ca} = \frac{v_1+\delta_T\phi_1}{v_B+\delta_T\phi_B}$ then $\gamma_{ca} = 1$, and is stable.

*Part (b), $\delta_B > \delta_T$*: The analysis parallels the case $\delta_B < \delta_T$, completing the proof. ■

**Proof of Proposition 6.** Special case of the equilibrium analysis of Online Appendix B. ■

**Proof of Proposition 7.** If the bidder offers $p$ then the gain from tendering is

$$\begin{aligned} & (q+\Delta)\left(p+\left(\alpha_T-\delta_T\right)\phi_1-v_0-\alpha_T\phi_0\right)-q\left(s_T+\sigma\left(v_0+\left(\alpha_T-\delta_T\right)\phi_1-v_1-\alpha_T\phi_1\right)\right) \\ = \ & \Delta s_T-(q+\Delta)\left(v_1+\delta_T\phi_1-p\right)-\sigma q\left(v_0+\left(\alpha_T-\delta_T\right)\phi_1-v_1-\alpha_T\phi_1\right). \end{aligned} \tag{A-26}$$

The bidder's per-shareholder payoff is

$$\gamma(q+\Delta)\left(v_1+\delta_B\phi_1-p\right)-(1-\gamma)\sigma q\left(v_0-v_1-\delta_B\phi_1\right), \tag{A-27}$$

where the second term reflects the bidder's litigation-induced acquisition of a share it values at $v_1+\delta_B\phi_1$ for a price $v_0$.

Note first that there is no equilibrium with $\gamma=1$, since from (A-26) such an equilibrium would require (using (32))

$$v_1+\delta_T\phi_1-p \leq -\sigma\left(v_0+\left(\alpha_T-\delta_T\right)\phi_1-v_1-\alpha_T\phi_1\right)<0,$$

which by balanced preferences implies that the bidder's payoff is strictly negative.

Hence the only possibility of $\gamma^*>0$ is if the tendering probability in the tendering subgame is interior. In this case, balanced preferences imply that the bidder's payoff is

$$\gamma\Delta s_T-\sigma q\left(v_0+\left(\alpha_T-\delta_T\right)\phi_1-v_1-\alpha_T\phi_1\right). \tag{A-28}$$

If $s_T<0$, the bidder optimally chooses $\gamma=0$ regardless of $\sigma$. Suppose $s_T>0$. Recall that $\gamma\Delta$ is is single-peaked in $\gamma$, obtaining its maximum at $\gamma=\kappa$.[39] By condition (32), it follows that (A-28) obtains its maximum at $\gamma<\kappa$. Applying Lemma A-1, the maximum is given by

$$\gamma^*(\sigma)=\kappa-\sigma(1-\kappa)\frac{v_0-v_1-\delta_T\phi_1}{s_T}.$$

Using (32), $\gamma^*(\sigma)$ is decreasing in $\sigma$ as required.

Finally: In footnote 32 we state that an analogous version of Proposition 7 holds if non-tendering shareholders litigate for cash compensation $v_1-v_0$ while retaining their shares.

[39] Formally: By the same arguments as in the proof of Lemma 1, the gain from tendering (A-26) is either monotone, single-peaked, or single-troughed in $\gamma$. Suppose that, contrary to the claimed result, the bidder's optimal offer $p$ induces an equilibrium $\gamma\geq\kappa$. Then the bidder would strictly increase its profits by marginally reducing $p$, leading to a marginally lower $\gamma$ in the tendering subgame.

In this case, the litigation condition (32) becomes $v_0 > v_1$; the gain from tendering (A-26) becomes $\Delta s_T - (q+\Delta)(v_1 + \delta_T\phi_1 - p) - \sigma q(v_0 - v_1)$; the bidder's payoff (A-27) becomes $\gamma(q+\Delta)(v_1 + \alpha_B\phi_1 - p) - (1-\gamma)\sigma q(v_0 - v_1)$ and (A-28) becomes $\gamma\Delta s_T - \sigma q(v_0 - v_1)$; and all steps in the argument are unchanged. ■

**Proof of Proposition 8.** *Case (i), $\delta_T > 0$, subcase $\phi_1 < \phi_0$:* $s_T < 0$ for all $N$ large enough. So an offer strictly in excess of $v_1 + \delta_{T,N}\phi_1$ is required to induce $\gamma^* = 1$. If $\phi_1 > 0$ then for $N$ large enough the bidder prefers $p = 0$. If instead $\phi_1 < 0$ then for $N$ large enough the bidder prefers an offer $p > v_1 + \delta_{T,N}\phi_1$ and certain acceptance to any offer that generates rejection.
*Case (i), $\delta_T > 0$, subcase $\phi_1 > \phi_0$:* As $N$ grows large,

$$\frac{\Pi}{N^2} \to \gamma\Delta\bar{\alpha}_T(\phi_1 - \phi_0) - \gamma(q+\Delta)\bar{\delta}_T\phi_1. \tag{A-29}$$

If $\phi_1 > 0$ it follows that if $\Lambda$ remains bounded away from 0 then $\Pi$ is negative, since $q$ dominates $\Delta$. Indeed, if $\Lambda^*$ is bounded away from zero in the limit, then necessarily $\gamma^* \geq \kappa$ in the limit, which implies that $q$ converges to a value weakly greater than 0.5. Since $\Delta \to 0$ regardless of the value of $\gamma$, $q$ dominates $\Delta$ in this limit case. Similarly, if $\phi_1 < 0$ then if $\Lambda$ remains bounded away from 1, the bidder would do better by choosing $\Lambda \to 1$.
*Case (ii), $\delta_{T,N} = \delta_B = 0$, subcase $\phi_1 < \phi_0$:* $s_T < 0$ for all $N$ large enough. So the bidder must offer $p > v_1$ to induce $\gamma^*$, yielding the bidder a payoff strictly less than $N(\alpha_B - \delta_B)\phi_1$. In contrast, the bidder can obtain the strictly higher payoff of $N(\alpha_B - \delta_B)\phi_0$ from the offer $p = 0$.
*Case (ii), $\delta_{T,N} = \delta_B = 0$, subcase $\phi_1 > \phi_0$:* $s_T > 0$ for all $N$ large enough. From the proof of Theorem 1, the bidder induces $\gamma^* \geq \kappa$, yielding the result on $\Lambda^*$. The result on the bidder's payoff $\Pi^*$ follows from the fact that $N\gamma\Delta$ evaluated at $\gamma = \kappa$ grows at rate at least $\sqrt{N}$ (see Lemma A-3). ■

# Online Appendix for
# "(Ir)responsible Takeovers"

## A Proofs of Lemmas A-1 – A-4

**Proof of Lemma A-1.** Here, adopt the convention that if $j > N$ then $\binom{N}{j} = 0$. We prove identity (A-2):

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

We prove identity (A-3):

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

■

**Proof of Lemma A-2.** We need to show

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

From Lemma A-1, 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. ■

**Proof of Lemma A-3.** Evaluating at $\gamma = \kappa$,

$$N\gamma\Delta = N\kappa \binom{N-1}{K-1} \kappa^{K-1} (1-\kappa)^{N-K} = \kappa N \binom{N}{K} \kappa^K (1-\kappa)^{N-K}.$$

We use the following two-sided Stirling bounds: for all integers $n \geq 1$,

$$\sqrt{2\pi n}\left(\frac{n}{e}\right)^n \leq n! \leq e\sqrt{n}\left(\frac{n}{e}\right)^n.$$

Applying the lower bound to $N!$ and the upper bound to $K!$ and $(N-K)!$, we obtain

$$\binom{N}{K} \geq \frac{\sqrt{2\pi N}(N/e)^N}{\left(e\sqrt{K}(K/e)^K\right)\left(e\sqrt{N-K}((N-K)/e)^{N-K}\right)}.$$

Simplifying yields

$$\binom{N}{K} \geq \frac{\sqrt{2\pi N}}{e^2\sqrt{K(N-K)}} \cdot \frac{N^N}{K^K(N-K)^{N-K}}.$$

Substituting in $K = \kappa N$:

$$\binom{N}{K} \geq \frac{\sqrt{2\pi}}{e^2\sqrt{\kappa(1-\kappa)}\sqrt{N}} \cdot \frac{1}{\kappa^K (1-\kappa)^{N-K}}.$$

Hence

$$N\gamma\Delta \geq \frac{\kappa\sqrt{2\pi}}{e^2\sqrt{\kappa(1-\kappa)}}\sqrt{N},$$

completing the proof. ■

**Proof of Lemma A-4.** First note that $N\binom{N-1}{K-1} = K\binom{N}{K}$. Hence we need to show that

$$\max_{\gamma} N\gamma\binom{N-1}{K-1}\gamma^{K-1}(1-\gamma)^{N-K} = \max_{\gamma} K\binom{N}{K}\gamma^K (1-\gamma)^{N-K}$$

is decreasing in $N$. Note that $\gamma^K(1-\gamma)^{N-K}$ is maximized by $\gamma = \frac{K}{N}$. Next note that

$$\frac{\binom{N-1}{K}\gamma^K (1-\gamma)^{N-1-K}}{\binom{N}{K}\gamma^K (1-\gamma)^{N-K}} = \frac{N-K}{N}\frac{1}{1-\gamma}.$$

This ratio equals 1 when evaluated at the maximizer of $\binom{N}{K}\gamma^K(1-\gamma)^{N-K}$, viz., at $\gamma = \frac{K}{N}$. It follows that

$$\max_{\gamma\in[0,1]}\binom{N-1}{K}\gamma^K(1-\gamma)^{N-1-K} > \max_{\gamma\in[0,1]}\binom{N}{K}\gamma^K(1-\gamma)^{N-K},$$

completing the proof. ■

# B Leveraged offers

A shareholder's payoff from retaining is

$$v_0 + \alpha_T\phi_0 + q(v_1 - d + \alpha_T\phi_1 - v_0 - \alpha_T\phi_0) = v_0 + \alpha_T\phi_0 + q(s_T - d), \tag{IA1}$$

while the payoff from tendering is given by (7). Hence the gain from tendering is

$$\tau_d(\gamma; p, d) \equiv \Delta(s_T - d) - (q + \Delta)(v_1 - d + \delta_T\phi_1 - p). \tag{IA2}$$

Consequently, the equilibrium of the tendering subgame is fully characterized by Lemma 1, where $v_1$ is replaced by $v_1 - d$ and $s_T$ is replaced by $s_T - d$.[40] The bidder's expected profit is given by (29).

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. Analogously to the definition of $\hat{v}_1$, define $\hat{v}_1(d) \equiv v_1 - d + \delta_T \phi_1$.

1. If $s_T > d$ then $\tau_d(\gamma; p, d) = 0$ in equilibrium, and hence from (29) the bidder's per-shareholder payoff is

$$\begin{aligned} & (1-\gamma) q d + \gamma \Delta (s_T - d) + \gamma (q + \Delta) d + \gamma (q + \Delta)(\delta_B - \delta_T) \phi_1 \\ = \quad & q d + \gamma \Delta s_T + \gamma (q + \Delta)(\delta_B - \delta_T) \phi_1 \end{aligned} \tag{IA3}$$

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

3. If $s_T = d$ then if $p = \hat{v}_1(d)$, any $\gamma \in [0,1]$ is a tendering probability in the subgame, and the bidder's per-shareholder payoff is, from (IA3),

$$(q + \gamma \Delta) d + \gamma (q + \Delta)(\delta_B - \delta_T) \phi_1.$$

   If $p > (<) \hat{v}_1(d)$ then the unique equilibrium of the tendering subgame is $\gamma = 1$ ($\gamma = 0$).

Next, we analyze the bidder's choice of $d$.

*Case: $s_T < 0$:* Bidding $p = \hat{v}_1(d) - (s_T - d) = \hat{v}_1 - s_T$ induces tendering probability $\gamma = 1$ and per-shareholder bidder profits

$$s_T + (\delta_B - \delta_T) \phi_1.$$

Note that leverage $d$ is irrelevant.

Alternatively, by lowering the bid to $p = \hat{v}_1 + \epsilon$ (where $\epsilon > 0$) the bidder induces both $\gamma = 0, 1$ as equilibria of the tendering subgame. In this case, the bidder's per-shareholder payoff if $\gamma = 1$ is played is

$$d - \epsilon + (\delta_B - \delta_T) \phi_1. \tag{IA4}$$

So in this case, the bidder chooses the maximal allowable leverage $d = v_1 - v_0$.

Hence:

[40] In the knife edge case in which $(p, d)$ are such that $s - d = 0$ and $p = v_1 - d + \delta_T \phi_1$ then $\gamma^* = [0,1]$.

- If $v_1 - v_0 < -(\delta_B - \delta_T)\phi_1 < 0$ then the takeover always fails.

- If $-(\delta_B - \delta_T)\phi_1 \leq v_1 - v_0 < \alpha_T\phi_0 - (\alpha_T - \delta_T + \delta_B)\phi_1$ then the bidder chooses leverage $d = v_1 - v_0$ and there is an equilibrium in which the takeover succeeds.

- If $v_1 - v_0 \geq \alpha_T\phi_0 - (\alpha_T - \delta_T + \delta_B)\phi_1$ then the bidder chooses between $p = \hat{v}_1 - s_T$ and indeterminate leverage, and $p = \hat{v}_1 + \epsilon$ and leverage $d = v_1 - v_0$, with the choice depending on the probability that the $\gamma = 1$ equilibrium is selected in the latter case.

*Case: $s_T > 0$ and $\phi_1 > \phi_0$:* The condition $s_T > d$ holds for any $d \in [0, v_1 - v_0]$, and so the bidder's per-shareholder payoff is given by (IA3). It immediately follows that the bidder sets $d$ to its maximal value of $d = v_1 - v_0$. It remains to characterize the bidder's choice of $\gamma$. Substituting in for $d$, the derivative of (IA3) with respect to $\gamma$ is $N\Delta$ times

$$\begin{aligned}
&\frac{1-\kappa}{1-\gamma}(v_1 - v_0) + \frac{\kappa-\gamma}{1-\gamma}s_T + \left(\frac{q}{N\Delta} + \kappa\right)(\delta_B - \delta_T)\phi_1 \\
= \; &\frac{\kappa-\gamma}{1-\gamma}(\alpha_T\phi_1 - \alpha_T\phi_0) + v_1 - v_0 + \left(\frac{q}{N\Delta} + \kappa\right)(\delta_B - \delta_T)\phi_1. \qquad \text{(IA5)}
\end{aligned}$$

Hence:

- If $v_1 - v_0 < -\kappa(\delta_B - \delta_T)\phi_1$ then $(\delta_B - \delta_T)\phi_1 < 0$ and so there exists $\epsilon > 0$ such that (IA5) is strictly negative for all $\gamma > \kappa - \epsilon$ and all $N$. Hence $\gamma^* \leq \kappa - \epsilon$.

- If $v_1 - v_0 > -\kappa(\delta_B - \delta_T)\phi_1$ then there exists $\epsilon > 0$ such that (IA5) is strictly positive for all $\gamma < \kappa + \epsilon$ and all $N$. Hence $\gamma^* \geq \kappa + \epsilon$.

*Case: $s_T > 0$ and $\phi_1 < \phi_0$:* If $d \in [0, s_T)$ then the bidder's per-shareholder payoff is given by (IA3), which is increasing in $d$. Hence by choosing $d$ sufficiently close to $s_T$, the bidder can approach a payoff of

$$qs + \gamma\Delta s_T + \gamma(q + \Delta)(\delta_B - \delta_T)\phi_1. \qquad \text{(IA6)}$$

Parallel to (IA5), the derivative of (IA6) with respect to $\gamma$ is $N\Delta$ times

$$s_T + \left(\frac{q}{N\Delta} + \kappa\right)(\delta_B - \delta_T)\phi_1. \qquad \text{(IA7)}$$

If $(\delta_B - \delta_T)\phi_1 \geq 0$ then (IA6) is strictly increasing in $\gamma$, while if $(\delta_B - \delta_T)\phi_1 < 0$ then, by Lemma A-2, (IA6) is concave in $\gamma$, with an interior maximum if and only if $s_T + \kappa(\delta_B - \delta_T)\phi_1 > 0$.

Alternatively, the bidder can choose leverage $d \in (s_T, v_1 - v_0]$. As in the case of $s_T < 0$ above: The bidder can ensure acceptance in the tendering subgame by offering $p = v_0 + \alpha_T\phi_0 -$

$(\alpha_T - \delta_T)\,\phi_1$ and obtain a per-shareholder payoff of (IA6) evaluated at $\gamma = 1$; or can lower the offer to $p = \hat{v}_1(d)$ and obtain both $\gamma = 0$ and $\gamma = 1$ as equilibria of the subgame, with payoff of (IA4) in the latter case.

Hence:

- If $(\delta_B - \delta_T)\,\phi_1 \geq 0$ then the bidder chooses leverage $d = v_1 - v_0$ and chooses between a high offer that obtains certain acceptance and a per-shareholder bidder payoff of $s_T + (\delta_B - \delta_T)\,\phi_1$, and a low offer that results in both $\gamma = 0$ and $\gamma = 1$ being tendering probabilities, and a payoff of $v_1 - v_0 + (\delta_B - \delta_T)\,\phi_1$ if the latter is played.

- If $(\delta_B - \delta_T)\,\phi_1 < 0$:

  - If $v_1 - v_0 < -(\delta_B - \delta_T)\,\phi_1 < 0$ then the takeover always fails.
  - If $-(\delta_B - \delta_T)\,\phi_1 \leq v_1 - v_0 < -\alpha_T(\phi_1 - \phi_0) - \kappa(\delta_B - \delta_T)\,\phi_1$ then the bidder chooses leverage $d = v_1 - v_0$ and there is an equilibrium in which the takeover succeeds.
  - If $v_1 - v_0 \geq -\alpha_T(\phi_1 - \phi_0) - \kappa(\delta_B - \delta_T)\,\phi_1$ then the bidder chooses between leverage $d = s_T - \epsilon$ and an offer $p \approx \hat{v}_1$ that is accepted with interior probability; and leverage $d = v_1 - v_0$ and an offer $p < \hat{v}_1$ that results in both $\gamma = 0$ and $\gamma = 1$ being tendering probabilities.

# C 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 $\zeta \in [0, 1)$; our baseline model is the special case $\zeta = 0$.[41] Following the discussion in Amihud et al (2004) and Mueller and Panunzi (2004), we assume that legal restrictions ensure

[41] 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 $q\zeta$ is $\sum_{j=F}^{N-1} \binom{N-1}{j} \gamma^j (1-\gamma)^{N-1-j}$, which is endogenous.

that minority shareholders receive the original offer $p$ in a freeze-out.[42] We assume throughout $\delta_B = \alpha_B$.

**Proposition IA-1.** *If $s_T < 0$ then the equilibrium is invariant to the freeze-out probability $\zeta$. If $s_T > 0$, then:*

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

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

Proposition IA-1 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, $\Delta s_T$, but the cost of contribution is effectively lower: If a shareholder retains his share, then with probability $q\zeta$ 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.[43] Since freeze-outs ameliorate non-excludability, they increase the bidder's probability of acquiring a share for a given offer, or alternatively, reduce the offer needed to induce a given tendering probability $\gamma$. In principle it is possible that the bidder responds by aggressively reducing the bid, so that the equilibrium success probability falls. But Proposition IA-1 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 IA-1.** With freeze-outs, a shareholder's expected utility from retaining a share is

$$v_0 + \alpha_T\phi_0 + q\,(1-\zeta)\,(v_1 + \alpha_T\phi_1 - v_0 - \alpha_T\phi_0) + q\zeta\,(p + (\alpha_T - \delta_T)\,\phi_1 - v_0 - \alpha_T\phi_0)\,. \quad \text{(IA8)}$$

[42] 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.

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

That is: with probability $q(1-\zeta)$ 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 $q\zeta$ 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 $(\alpha_T - \delta_T)\phi_1$.

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 (7). Hence the marginal benefit of tendering is

$$\tau_\zeta(\gamma;p) \equiv \Delta s_T - (q(1-\zeta)+\Delta)(\hat{v}_1 - p), \tag{IA9}$$

which takes the same form as its no-freeze-out analogue (8), with the sole difference being that the probability $q$ of holding out and benefiting from a takeover is reduced to $(1-\zeta)q$.

Next, the bidder's expected payoff per shareholder is

$$(\gamma(q+\Delta)+(1-\gamma)\zeta q)(v_1 - p + \delta_B\phi_1). \tag{IA10}$$

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

It is straightforward to replace $\tau$ with $\tau_\zeta$ in the proof of Lemma 1, where $\zeta \in [0,1)$. If $s < 0$, the equilibrium of the tendering subgame exactly coincides with the no-freeze-out baseline ($\zeta = 0$). 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 $s_T > 0$. The bidder's profit in a mixed-strategy equilibrium is $N$ times

$$\begin{aligned}
& \left(\gamma\left(q+\Delta\right)+\left(1-\gamma\right)q\zeta\right)\left(v_1-\mu_\zeta\left(\gamma\right)+\delta_B\phi_1\right) \\
= & \left(\gamma\left(q\left(1-\zeta\right)+\Delta\right)+q\zeta\right)\left(v_1-\hat{v}_1+\frac{\Delta}{q\left(1-\zeta\right)+\Delta}s_T+\delta_B\phi_1\right) \\
= & \left(\gamma\left(q\left(1-\zeta\right)+\Delta\right)+q\zeta\right)\left(\frac{\Delta}{q\left(1-\zeta\right)+\Delta}s_T+\left(\delta_B-\delta_T\right)\phi_1\right) \\
= & \left(\Delta\gamma+\zeta\frac{\Delta q}{q\left(1-\zeta\right)+\Delta}\right)s_T+\left(\gamma\left(q\left(1-\zeta\right)+\Delta\right)+q\zeta\right)\left(\delta_B-\delta_T\right)\phi_1. \qquad \text{(IA11)}
\end{aligned}$$

Moreover, the minimum offer that generates $\gamma=1$ as an equilibrium for the tendering subgame is $p=\hat{v}_1$, which gives profits of $N\left(\delta_B-\delta_T\right)\phi_1$, coinciding with the expression above as $\gamma\to 1$. Consequently the bidder effectively chooses $\gamma\in[0,1]$ to maximize (IA11).

Suppose $\delta_B\neq\delta_T$. We show that large $N$ the outcome is same as for non-freezeout case. The bidder's profit in (IA11) can be rewritten as

$$\left(\gamma\left(q+\Delta\right)+q\zeta\left(1-\gamma\right)\right)\left[\frac{\Delta}{q\left(1-\zeta\right)+\Delta}S_T+\left(\delta_B-\delta_T\right)\Phi_1\right]$$

Suppose $\left(\delta_B-\delta_T\right)\Phi_1<0$. Notice $\Delta\to 0$ regardless of $\gamma^*$. 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 $\left(\delta_B-\delta_T\right)\Phi_1\times\lim_{N\to\infty}\left(\gamma q+q\zeta\left(1-\gamma\right)\right)<0$, a contradiction. Therefore, it must be $\Lambda^*\to 0$.

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

$$\begin{aligned}
& \left(\delta_B-\delta_T\right)\Phi_1\lim_{N\to\infty}\left(\gamma q+q\zeta\left(1-\gamma\right)\right) \\
< & \left(\delta_B-\delta_T\right)\Phi_1\lim_{N\to\infty}\left(\gamma+\zeta\left(1-\gamma\right)\right) \\
\leq & \left(\delta_B-\delta_T\right)\Phi_1,
\end{aligned}$$

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

Suppose $\delta_B=\delta_T$. From (IA11), the bidder's problem reduces to choosing $\gamma$ to maximize

$$\Delta\gamma+\zeta\frac{\Delta q}{q\left(1-\zeta\right)+\Delta}. \qquad \text{(IA12)}$$

The term $\Delta\gamma$ is single-peaked and obtains its maximum at $\gamma=\frac{K}{N}$. Differentiating the second term in (IA12) gives

$$
\begin{aligned}
\frac{\partial}{\partial\gamma}\left(\frac{\Delta q}{q\left(1-\zeta\right)+\Delta}\right) &= \frac{\left(\left(1-\zeta\right)q+\Delta\right)\left(q\frac{\partial\Delta}{\partial\gamma}+\Delta\frac{\partial q}{\partial\gamma}\right)-\Delta q\left(\left(1-\zeta\right)\frac{\partial q}{\partial\gamma}+\frac{\partial\Delta}{\partial\gamma}\right)}{\left(\left(1-\zeta\right)q+\Delta\right)^2} \\
&= \frac{\left(1-\zeta\right)q^2\frac{\partial\Delta}{\partial\gamma}+\left(1-\zeta\right)q\Delta\frac{\partial q}{\partial\gamma}+\Delta q\frac{\partial\Delta}{\partial\gamma}+\Delta^2\frac{\partial q}{\partial\gamma}-\Delta q\left(1-\zeta\right)\frac{\partial q}{\partial\gamma}-\Delta q\frac{\partial\Delta}{\partial\gamma}}{\left(\left(1-\zeta\right)q+\Delta\right)^2} \\
&= \frac{\left(1-\zeta\right)q^2\frac{\partial\Delta}{\partial\gamma}+\Delta^2\frac{\partial q}{\partial\gamma}}{\left(\left(1-\zeta\right)q+\Delta\right)^2}. \qquad \text{(IA13)}
\end{aligned}
$$

To establish that the bidder selects $\gamma > \frac{K}{N}$ we show that (IA13) is strictly positive for all $\zeta > 0$ and $\gamma \leq \frac{K}{N}$. Note that $\frac{\partial\Delta}{\partial\gamma} > 0$ if and only $\gamma < \frac{K-1}{N-1}$,[44] while $\frac{\partial q}{\partial\gamma} > 0$ for all $\gamma \in (0,1)$. Hence (IA13) is strictly positive for all $\gamma \leq \frac{K-1}{N-1}$. So it remains to show that (IA13) is strictly positive for $\gamma \in \left(\frac{K-1}{N-1}, \frac{K}{N}\right]$; and it suffices to establish this statement at $\zeta = 0$.

Expanding (using Lemma A-1), 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,

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

From Lemma A-2, the ratio $\frac{\Delta}{q}$ is decreasing in $\gamma$, and so it suffices to establish the inequality at $\gamma = \frac{K}{N}$. By straightforward manipulation, this is equivalent to

$$\sqrt{K}\Delta > q \text{ at } \gamma = \frac{K}{N}. \qquad \text{(IA14)}$$

We establish inequality (IA14) in two steps. First, we fix $K \geq 2$, and establish the inequality for $N = 2K$. Second, we show that if (IA14) 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

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

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 (IA14) 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 $\gamma = \frac{K}{N}$,

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

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 (IA14).

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

$$\arg\max_{\gamma\in[0,1]}\left(\Delta\gamma+\zeta\frac{\Delta q}{q\left(1-\zeta\right)+\Delta}\right). \tag{IA15}$$

Note that both $\gamma = 0, 1$ give zero bidder profits, and so certainly the bidder's choice of $\gamma$ is interior. From (IA13) we know that if

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

for some $\gamma$ and $\zeta$, then this inequality holds strictly for any $\tilde{\zeta} > \zeta$: this follows trivially if $\frac{\partial\Delta}{\partial\gamma} \geq 0$, and follows easily if $\frac{\partial\Delta}{\partial\gamma} < 0$. Consequently, (IA15) is strictly increasing in $\zeta$ over any neighborhood of $\zeta$ -values in which it is unique. Finally, suppose there is some $\zeta$ at which both $\gamma_1$ and $\gamma_2 > \gamma_1$ maximize the bidder's objective (IA12). Let $q_1, \Delta_1, q_2, \Delta_2$ denote $q$ and $\Delta$ evaluated at $\gamma_1$ and $\gamma_2$. Note that

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

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

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

Note that

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

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

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

It again follows that the bidder's profit-maximizing choice $\gamma$ is increasing in $\zeta$.

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

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

Fix $\gamma > \kappa$: the term inside the parentheses converges (as $N \to \infty$, using $\Delta \to 0$ and $q \to 1$) to

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

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

# D Unconditional offers

We consider an unconditional tender offer, in which the bidder offers $p$ for each share in the target *without* the condition that at least $K$ shareholders accept.

To summarize: relative to a conditional offer, an unconditional offer introduces a gain/loss from trade if $(\delta_B - \delta_T) \phi_0 \neq 0$; and under some conditions, different feasibility/multiplicity of tendering probabilities in the tendering subgame.

## D.1 Basics

A shareholder's payoff from accepting an unconditional offer is simply

$$p + (q + \Delta)(\alpha_T - \delta_T)(\phi_1 - \phi_0) + (\alpha_T - \delta_T)\phi_0.$$

A shareholder's payoff from retention continues to be given by (6). Hence the gain from tendering is

$$\tau_{un}(\gamma; p) = \Delta s_T + (p - v_0 - \delta_T \phi_0) - (q + \Delta)(s_T - (\alpha_T - \delta_T)(\phi_1 - \phi_0)).$$

Note that

$$\begin{aligned}\tau_{un}(0;p) &= p - v_0 - \delta_T\phi_0 \\ \tau_{un}(1;p) &= p - v_1 - \delta_T\phi_1.\end{aligned}$$

In particular, and in contrast to the case of conditional offers, whether or not $\gamma = 0$ is an equilibrium of the tendering subgame is determined by whether $p$ exceeds $v_0 + \delta_T\phi_0$.

Differentiation yields

$$\begin{aligned}\frac{\partial \tau_{un}}{\partial \gamma} &= \left(\left(\frac{K-1}{\gamma} - \frac{N-K}{1-\gamma}\right)s_T - \frac{K-1}{\gamma}\left(s_T - \left(\alpha_T - \delta_T\right)\left(\phi_1 - \phi_0\right)\right)\right)\Delta \\ &= \left(\frac{K-1}{\gamma}\left(\alpha_T - \delta_T\right)\left(\phi_1 - \phi_0\right) - \frac{N-K}{1-\gamma}s_T\right)\Delta.\end{aligned}$$

Consequently, if $s_T < 0$ then $\tau_{un}$ is monotone increasing if $\phi_1 \geq \phi_0$, and is decreasing then increasing if $\phi_1 < \phi_0$; while if $s_T > 0$ then $\tau_{un}$ is increasing then decreasing if $\phi_1 > \phi_0$, and is monotone decreasing $\phi_1 \leq \phi_0$.

Hence: Different from the case of conditional offers: if $s < 0$ then there may exist a stable interior equilibrium of the tendering subgame if $\phi_1 < \phi_0$; and if $s > 0$ and $\phi_1 > \phi_0$ then multiple equilibira of the tendering subgame may exist, and not all tendering probabilities $\gamma$ are achievable.

The bidder's per-shareholder payoff is

$$\gamma\left(v_0 + \delta_B\phi_0 + (q+\Delta)\left(v_1 + \delta_B\phi_1 - v_0 - \delta_B\phi_0\right) - p\right).$$

If the tendering probability is interior then the bidder's per-shareholder payoff is (using $\tau_{un} = 0$)

$$\gamma\Delta s_T + \left(\delta_B - \delta_T\right)\gamma\left((q+\Delta)\left(\phi_1 - \phi_0\right) + \phi_0\right). \tag{IA16}$$

From (15), if $p_{un}$ and $p$ are, respectively, unconditional and conditional offers that both induce the same tendering probability $\gamma < 1$, then the bidder's profits are same in the two cases if $\left(\delta_B - \delta_T\right)\phi_0 = 0$.

As a final (and trivial) preliminary observation: if $p_{un}$ and $p$ are, respectively, unconditional and conditional offers that both induce $\gamma = 1$ then both bidder and target-shareholder payoffs are identical across the two offers.

## D.2 Direct gains/losses from trade: $(\delta_B - \delta_T)\,\phi_0 \neq 0$

A potential gain from using an unconditional offer arises if

$$(\delta_B - \delta_T)\,\phi_0 > 0.$$

If a target shareholder holds the share under status quo operations, the utility from externality-exposure is $\alpha_T \phi_0$, while if the share is held by the bidder the combined (across divested target shareholder and bidder) utility from externality-exposure increases to $(\alpha_T - \delta_T)\,\phi_0 + \delta_B \phi_0$, even without any change in operations. In this case, unconditional offers enjoy a potential advantage stemming from this utility gain.

Similarly, if

$$(\delta_B - \delta_T)\,\phi_0 < 0$$

then unconditional offers are at a disadvantage because of the utility loss.

## D.3 No direct gains/losses from trade: $\phi_0 = 0$

In order to focus on differences between unconditional and conditional offers stemming from effects that go beyond the direct gains from trade just discussed, we assume now that

$$\phi_0 = 0.$$

Moreover, and for purely for conciseness, we assume

$$\delta_B \leq \delta_T,$$

which we take to be the more relevant case in practice. We establish:

**Proposition IA-2** *Suppose that $\phi_0 = 0$ and $\delta_B \leq \delta_T$. The bidder strictly prefers an unconditional offer to a conditional offer* only if *$s_T < 0$, $\phi_1 < 0$ and $\delta_B < \delta_T$.*

Proposition IA-2 identifies relatively narrow criteria under which a bidder would favor unconditional offers. When these criteria are met, the specific advantage that an unconditional offer delivers is better equilibrium selection (from the bidder's perspective).

In many cases, if unconditional offers are favored, the effect is to increase the probability of a socially inefficient takeover.

**Proof of Proposition IA-2.** First, consider the case of $s > 0$. Suppose the bidder make an unconditional offer $p_{un}$ and that shareholders tender with probability $\gamma_{un}$. If $\gamma_{un} = 1$ then

$p_{un} \geq v_1 + \delta_T \phi_1$, and the bidder can achieve the same outcome as a unique equilibrium by making a conditional offer. If instead $\gamma_{un} < 1$ then from (IA16) the bidder can again achieve the same outcome as a unique equilibrium by making a conditional offer.

Second, consider the case of $s_T < 0$ and $\phi_1 > 0$. Suppose the bidder makes an unconditional offer $p_{un}$ and that shareholders tender with probability $\gamma_{un}$. If $\gamma_{un} = 1$ then $p_{un} > v_1 + \delta_T \phi_1 \geq v_1 + \delta_B \phi_1$; this cannot be an equilibrium since the bidder's payoff is strictly negative. Similarly, $\gamma_{un} \in (0, 1)$ cannot be an equilibrium since from (IA16) the bidder's payoff is strictly negative. Hence the takeover must fail under an unconditional offer, and the bidder can trivially replicate this outcome under a conditional offer.

Third, consider the case of $s_T < 0$ and $(\delta_B - \delta_T)\,\phi_1 = 0$. By parallel steps to above, the bidder's payoff under an unconditional offer are weakly negative, and the bidder can trivially replicate this outcome under a conditional offer.

Finally, consider the case of $s_T < 0$ and $\phi_1 < 0$ and $\delta_B < \delta_T$. If the bidder makes a conditional offer of $p = v_1 + \delta_T \phi_1 + \epsilon < v_1 + \delta_B \phi_1$ then it obtains a strictly positive payoff if shareholders play $\gamma = 1$ in the subgame; but there also exists an equilibrium in which shareholders play $\gamma = 0$ in the subgame. In order to eliminate the $\gamma = 0$ equilibrium the bidder would need to raise the offer to $v_1 + \delta_T \phi_1 - s_T = v_0 - (\alpha_T - \delta_T)\,\phi_1 > v_0$. In contrast, by making an unconditional offer of $\max\{v_0, v_1 + \delta_T \phi_1\} + \epsilon$ the bidder preserves the $\gamma = 1$ and eliminates the $\gamma = 0$ equilibrium. The advantage of the unconditional offer is especially clear if $v_0 \leq v_1 + \delta_T \phi_1$, since in this case an unconditional offer of $p = v_1 + \delta_T \phi_1 + \epsilon$ eliminates the $\gamma = 0$ outcome of the tendering subgame at zero cost. ■

# E Microfoundation of invariant social preferences

In this appendix, we demonstrate that the leading case in which $\alpha_T$ and $\delta_T$ are invariant to $N$ arises if a shareholder's total wealth scales proportionally with ownership $1/N$ of the target, and if the relative weights that shareholders place on personal consumption and social externalities are independent of wealth.

The invariance to $N$ corresponds to shareholders trading off financial value $V = V(\Phi)$ and externalities $\Phi$ in a way that is independent of the stake $\frac{1}{N}$ in the firm. Let $c$ denote individual consumption. A shareholder has preferences

$$U(c, \Phi) = u(\Phi)\,\frac{1}{1-\alpha} c^{1-\alpha}.$$

Then, if $c = \frac{V}{N}$, and a shareholder controls the tradeoff between $V$ and $\Phi$, the FOC is

$$u'(\Phi)\frac{1}{1-\alpha}\left(\frac{V}{N}\right)^{1-\alpha} + u(\Phi)\frac{V'}{N}\left(\frac{V}{N}\right)^{-\alpha} = 0,$$

which is independent of $N$.