LBO Financing*

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May 2021

Abstract

We analyze takeover financing in a model where bidders must overcome the free-rider problem to restore ownership incentives. Bootstrapping, "excessive" debt levels, and negative financing contributions by bidders—the controversial traits of leveraged buyouts—emerge as the Pareto efficient takeover bid design. Takeover debt is crucial to equity consolidation, Pareto sharing of the incentive gains, and efficient takeover competition, all while wealth constraints are slack. These benefits are unique to the market for corporate control, that is, absent outside of takeovers.

JEL Classification: G34, G32.

Keywords: Leveraged buyouts, bootstrap acquisitions, tender offers, free-rider problem, debt overhang, private equity

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*We thank Ulf Axelson, Patrick Bolton, Martin Oehmke, Thomas Geelen, Elu von Thadden and seminar participants at Lausanne, LSE, the Stockholm School of Economics, the HEC-McGill Winter Finance Workshop, the Cambridge Corporate Finance Symposium, and ESSFM for helpful comments. An earlier version of the paper circulated under the title "The Social Value of Debt in the Market for Corporate control". Please send correspondence to: Mike Burkart, Room OLD M3.02, London School of Economics and Political Science, Houghton Street, London WC2A 2AE, UK. Telephone: +44 (0)20 7107 5049. Email: m.c.burkart@lse.ac.uk.

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> "Leverage" refers to the fact that the company being purchased is forced to pay for... its own acquisition... If this sounds like an odd arrangement, that's because it is. (Kosman 2012, para.8).

1 Introduction

The rise of leveraged buyouts (LBOs) in the 1980s and subsequently of private equity (PE) firms marks a watershed in the history of corporate governance (e.g., Shleifer and Vishny 1990; Holmstrom and Kaplan 2001; Kaplan and Stromberg 2009). PE firms are now a large and influential industry, manifesting Manne (1965)'s vision of a market for corporate control. A controversial trait of these buyouts is how leveraged they are. On one hand, advocates see debt as a means to efficiently restore incentives in the target firms (e.g., Jensen 1988). On the other hand, critics worry that it serves to extract rents from other stakeholders, leading to inefficiently high leverage (e.g., Shleifer and Summers 1988).

With the role of PE funds in the economy growing, this debate remains relevant. By some estimates, PE funds in the U.S. managed almost $7 trillion in assets in 2018, and in some sectors, like retail, nearly all recent bankruptcies involve PE-owned firms (Appelbaum and Batt 2018; Scigliuzzo et al. 2019). Rattled by such trends, policy-makers are considering regulations, reminiscent of similar efforts in the 1980s.[1] Given the scale of PE today, understanding what drives buyout leverage matters even more as the aggregate leverage created by PE deals can have economy-wide repercussions (Kosman 2009). In this paper we revisit this question and develop a model to explain the controversial traits of LBO financing. Before describing our theory we discuss the main extant explanations and their limitations.

Incentive-benefit theory. The dominant theory is that debt imposes discipline to pay out free cash flow and raises incentives to create value (Jensen 1986; Innes 1990).

[1] An example is the "Stop Wall Street Looting Act" sponsored by U.S. Senator Elizabeth Warren (https://www.congress.gov/bill/116th-congress/senate-bill/2155).

While persuasive, the theory has serious limitations because debt has no role besides optimizing *post-takeover* incentives. In particular, it does not require the takeover to be leveraged. The debt could as well be raised after (or in management buyouts even before) the takeover.[2] Furthermore, the theory is not consistent with the practice of bootstrapping, which we elaborate on below. If leveraging the takeover were merely a matter of convenience, leverage should depend on similar factors as general corporate leverage, which lacks empirical support (Axelson et al. 2013). Indeed, the theory cannot explain why buyout leverage is much higher than general corporate leverage.

These limitations vindicate critics who target *how* and *how much* debt is raised. In LBOs, bidders get funding by indebting the targets. Kosman (2009, p.3) compares this so-called bootstrapping[3] to mortgage debt except "while we pay our mortgages, PE firms had the companies they bought take the loans, making *them* responsible for repayment." As summarized in a recent congressional hearing, this tactic is criticized for leaving the PE firms with "little to no skin in the game." (America for Sale? An Examination of the Practices of Private Funds 2019, p.4).[4] Specifically, since targets and not PE funds bear the debt, PE firms lose at most their equity investment, which they often recover early on through fees collected from the targets—all while the high leverage puts target stakeholders, notably workers, at risk.

The point is that bootstrapping limits PE firms' liability with respect to the debt. This is a conundrum for incentive-benefit theory; limited liability weakens incentives. Deal-by-deal debt at the PE fund or in a special purpose entity would give PE firms more skin in the game. This insinuates a less benign motive for the debt, as reflected in the moniker "raiders."

A related point is that, net of fees received (often at or shortly after a deal), PE

[2]The reason is that the benefit of debt identified in these theories applies to capital structure and financing choices in general, that is, also outside of takeovers.

[3]The origin of LBOs were deals Jerome Kohlberg, Jr., Henry Kravis, and George Roberts started making in the 1960s that they referred to as bootstrap investments.

[4]The testimony is by Eilene Appelbaum, co-director of the Center for Economic Policy Research (CEPR) and co-author of *Private Equity at Work: When Wall Street Manages Main Street*, which was a finalist in 2016 for the Academy of Management's George R. Terry Book Award.

firms' financing contributions are often small or even negative.[5] This is also hard to square with standard incentive theory where wealth constraints bind in equilibrium; rather than cash out, bidders would reduce outside financing. In terms of incentives, cashing out looks dubious.

As the incentive-benefit theory provides no efficiency rationale for bootstrapping, nor for why the resultant leverage is so high, the suspicion that it (unlike bidder debt) serves to increase bidder rents at the expense of other target stakeholders seems by no means far-fetched.

Rent-extraction theory. Müller and Panunzi (2004) show that *takeover frictions* create a role for bootstrapping. Bootstrapping helps overcome the free-rider problem (Grossman and Hart 1980) by shifting part of the takeover gains from target shareholders to bidders. The insight is that bootstrapping can be socially valuable because it promotes value-increasing takeovers. But there are two caveats.

First, the theory actually reinforces policy concerns. Conditional on the takeover, bootstrapping is at best a zero-sum transfer; given bankruptcy costs or externalities, it induces too much leverage.[6] This warrants a cap on bootstrapping, which does not conflict with incentive-benefit theory, since the latter does not require bootstrapping.

Second, a theory equating takeover debt to bidder profit squares poorly with evidence that the 1980s LBOs mainly profited target shareholders (Jarrell et al. 1988). The theory also predicts less bootstrapping when bidders compete. In the late 1980s, bidder returns decreased due to increased competition, but takeover leverage did not (Kaplan and Stein 1993; Andrade and Kaplan 1998; Holmstrom and Kaplan 2001).[7]

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[5]The term bootstrapping stems from the expression "pull oneself up by one's bootstraps," which is a metaphor for achieving success with few means and little help. In the case of LBOs, the term is used because bidders acquire targets with little to no capital of their own.

[6]See Section VI.B in Müller and Panunzi (2004).

[7]Müller and Panunzi remark on the difficulty of explaining such patterns with their model:

> "[A] minimal amount of debt equal to the raider's transaction cost might be sufficient to ensure that the takeover takes place. Indeed, if debt is costly and the raider's profit is limited due to bidding competition, it is precisely this minimal amount of debt that is optimal. Hence, while our model provides a role for debt in takeovers, it cannot explain LBO-style debt levels." (Müller and Panunzi 2004, p.1220).

This caveat is also orthogonal to incentive-benefit theory. If anything, explaining low bidder profits in highly leveraged bootstrap acquisitions seems harder when leverage also improves incentives.

In short, neither the incentive-benefit nor the rent-extraction theory account for bootstrapping in a way that quells the criticism or matches the empirical patterns.

A unified theory. In this paper we develop a theory that gives a stronger normative justification for bootstrapping, matches the evidence, and bridges the two strands of theory. We extend the model of Grossman and Hart (1980) along two dimensions: a pre-bid stage in which bidders can procure financing (as in Müller and Panunzi 2004) and a post-takeover stage in which the incentives to improve firm value depend on its financing structure (as in Burkart et al. 1998).

In our theory, debt financing does not improve incentives unless the acquisition is bootstrapped; these incentive benefits cannot be replicated outside of the takeover, that is, they require *takeover* debt. Moreover, bootstrapping can mainly profit target shareholders, although bidders use it to extract gains. This is particularly true under competition, which leads to *more* takeover debt. A cap on bootstrapping hurts target shareholders as well as bidders. Bootstrapping, excessive leverage, and negative cash contributions by bidders emerge as a *Pareto* efficient bid design.

These results crucially hinge on trilateral interactions between financing choices, free-riding behavior, and post-takeover moral hazard that are absent when incentive problems and rent extraction are analyzed separately. These interactions create new mechanisms, specific to our unified theory:

1. **Ownership-leverage link**. The free-rider problem keeps bidders from buying large target stakes. Bootstrapping lets them extract rents. But as lenders' debt supply depends on how much value they expect to be created, bidders can only obtain more debt if they improve their own incentives by buying larger stakes. *So bootstrapping encourages ownership consolidation and hence increases post-takeover firm values, while letting bidders cash out more upfront* (Propositions

1 and 3).

2. **Sharing rule**. The incentive problem constrains the bidder's debt capacity: a wedge between debt and firm value that puts equity sufficiently in-the-money is needed to avoid the debt overhang problem. Because of the free-rider problem, this wedge (post-takeover equity value) is what target shareholders extract in the takeover. Under common specifications of the incentive problem, the wedge increases in debt *such that the debt constraint imposes Pareto sharing* (despite free-riding) of the gains induced by bootstrapping (Proposition 2).

3. **Boosting competition**. Bootstrapping raises the maximum value a bidder is willing to create by allowing her to better recoup costs. But because free-riding shareholders share in the gains, her profit-maximizing bid does not exhaust her debt capacity, or put differently, it is not the most efficient bid she can arrange. *Competing bidders push each other to more efficient bids with higher debt levels* (Propositions 4 and 5).

To the best of our knowledge, we are the first to explain *high levels of debt raised through bootstrapping in excess of financing needs* as an efficient financing structure. The underlying arguments are not present in non-takeover models and thus identify a unique role for debt in the market for corporate control. Being based on dispersed target ownership, our theory is less relevant for private-to-private buyouts (Boucly et al. 2011; Chung 2011; Cohn et al. 2020) or divisional buyouts (unless in spinoffs), implying leverage should be higher in public-to-private deals.

2 Related Literature

As we have already motivated, our paper connects two strands in the theory of buyouts: incentive effects of debt (e.g., Jensen 1986; Innes 1990) and free-riding in tender offers (e.g., Grossman and Hart 1980; Burkart et al. 1998; Müller and Panunzi 2004). In this section, we elaborate on insights that stem from this connection.

Contribution to the incentive theory of buyouts. The rent-extraction motive introduced by free-riding behavior generates a different incentive benefit of debt than standard theory, one that operates through potential agency *costs* of debt: to avoid debt overhang while raising debt to extract rents, the bidder must buy a larger stake that improves her incentives. In our model this is embodied in an ownership-leverage function that maps feasible debt levels to required equity stakes. Intuitively, it strikes a balance between "raiding" the target and post-takeover incentives. Empirically, it implies a positive link between the post-buyout equity incentives of the insiders and buyout debt.[8]

Moreover, the rent-extraction motive for debt can explain systematic differences between buyout leverage and corporate leverage. The standard explanation for debt in LBOs is the same as in ordinary capital structure theory: achieving a second-best outcome under wealth constraints (e.g., Innes 1990).[9] One expects limiting wealth in our model to add this role to debt, but any wealth constraint would be slack because the rent-extraction level of debt exceeds the need for outside funds.

Indeed, the bidder's need for outside funds is always *negative* in our model. That is, the funds she raises from outside investors exceed the total consideration she pays target shareholders. Standard financing models predict that wealth constraints bind: the bidder uses all her own funds (as little outside funding as possible). The negative capital contributions do not signify a "free lunch." External financing is conditional on the bidder taking equity that incentivizes her to create a certain amount of value. Her rents are returns to *human* capital.[10]

Last but not least, a fundamental distinction is that (high) buyout leverage in our model is *driven by the transaction*, not by long-run capital structure considerations.

[8] This describes a causal effect, not a cross-sectional correlation, as elaborated on in Section 4.1.

[9] In our model, bidders are capable of establishing the first-best post-takeover incentive structure by self-financing the entire takeover.

[10] Kaplan and Stein (1993, p.341) note that incumbent managers that stay on in target typically cash out some of their pre-buyout holdings even as their percentage ownership in the post-buyout (more highly levered) equity increases, and point out that this could have adverse incentive effects. This is different from the effect in our model where bidders cash out without any pre-buyout stakes and their ability to do so is a sign of incentive improvements.

The benefits of debt in our model require bootstrapping. None of them are replicable through a recapitalization before or after the buyout. Relatedly, our reasoning would suggest that targets (attempt to) decrease their leverage to "normal" corporate levels after the buyout, which is less obvious if buyouts implement optimal (target) capital structure. Put differently, in our theory, high buyout leverage can be efficient even if it is much higher than what is (perceived to be) optimal in the industry.[11]

Contribution to the literature on tender offers. A key theme of this literature is to identify mechanisms whereby bidders can unilaterally exclude free-riding target shareholders from part of the takeover gains. The main known exclusion mechanisms are dilution (Grossman and Hart 1980), toeholds (Shleifer and Vishny 1986), and takeover debt (Müller and Panunzi 2004).[12] But they are no panacea. Their Achilles heel is that, while facilitating bids, they hurt target shareholders conditional on a bid. A common result in this literature is that target shareholders want limits to exclusion even if those deter some takeovers.[13] Our paper identifies an exception to this rule.

Takeover debt is not a unilateral mechanism since it requires lender participation. In the presence of agency problems, this generates financing constraints, which limit exclusion and thereby impose a "sharing rule" on bidders. By way of incentive gains and a sharing rule, bootstrapping benefits target shareholders even under a given bid (for common formulations of the incentive problem). In a nutshell, it simultaneously tackles two problems of dispersed ownership: it *promotes ownership concentration to restore incentives* and *resolves the free-rider problem to mutual benefit.* This makes it a 'silver bullet' for takeovers of widely held firms.

[11]Otherwise, there would be a tension when arguing that the high buyout leverage represents the optimal capital structure for a target (even though significantly raising the risk of financial distress) despite the much lower leverage ratio in the target's industry. This tension is, for instance, palpable in Andrade and Kaplan (1998, notably Sections II and VI.B).

[12]Freeze-out mergers offer an alternative mechanism (Yarrow 1985; Amihud et al. 2004), but this mechanism is not robust to legal or strategic uncertainty (Müller and Panunzi 2004; Dalkir, Dalkir, and Levit 2019). There are few comparisons as the various mechanisms are economically equivalent in standard tender offer models. If anything, it is stressed how *similar* they are (Müller and Panunzi 2004; Burkart and Lee 2015).

[13]This rent-efficiency trade-off appears in many guises, e.g., in disclosure laws that limit toehold acquisition, minority shareholder protection laws to restrict dilution, dissenters' rights that weaken freeze-outs, and supermajority voting rules that force bidders to acquire more shares.

Our model combines the frameworks of Burkart, Gromb, and Panunzi (1998) and Müller and Panunzi (2004), which overturns some of their key predictions. Allowing for takeover debt qualifies Burkart, Gromb, and Panunzi's finding that single bidders buy the smallest possible equity stake. The incentive benefit of debt reverses Müller and Panunzi's conclusion that takeover debt harms target shareholders and decreases under bidding competition. An extension in Section 6 of the discussion paper version (Müller and Panunzi 2003), not included in the published article, is closely related to our paper. It shows that moral hazard constrains debt financing but does not explore the ramifications for efficiency, surplus sharing, and competition.

Other papers. Burkart, Gromb, Müller, and Panunzi (2014) examine how investor protection laws impact (the financing of) tender offers by wealth-constrained bidders. Axelson, Stromberg, and Weisbach (2009) study optimal contracts between private equity firms and passive capital providers (limited partners). Malenko and Malenko (2015) propose an explanation for the high levels of buyout leverage based on buyout firms' reputational concerns vis-à-vis lenders. Last, several papers explore the role of debt in bidding contests. They are discussed in Section 4.4.

3 Financing Tender Offers

We present a tender offer model with financing in which the *source* of takeover gains is an improvement in incentives while the *distribution* of those gains is subject to the free-rider problem. It is the first model in the tradition of Grossman and Hart (1980) in which debt and (outside) equity financing both play a critical role.

3.1 Model

Source of takeover gains. A widely held firm ("target") faces a potential acquirer ("bidder"). If the bidder gains control, she generates a value improvement $V(e)$ over the firm's status quo value, which is normalized to 0. Generating value requires effort

$e \in \mathbb{R}_0^+$, which imposes a private cost $C(e)$ on the bidder.

We assume a linear value improvement function, $V(e) = \theta e$, where $\theta > 0$ is the marginal return to effort. The cost function is twice differentiable, strictly increasing, and strictly convex, i.e., $C'(e) > 0$ and $C''(e) > 0$ for all $e \geqslant 0$. We further assume $C(0) = 0$, $\lim_{e \to 0} C'(e) = 0$, and $\lim_{e \to \infty} C'(e) = +\infty$ to restrict attention to strictly positive but finite post-takeover values. While V and C are commonly known, effort e is unobservable.[14]

The post-takeover moral hazard can alternatively be modeled as private benefit extraction (as Burkart et al. 1998). This would add a source of bidder gains without altering the key insights; more effort would map into less extraction. Also, while we model post-takeover effort, all results apply equally to efforts in preparation of a bid (such as assessing target suitability and identifying potential improvements) as long as effort is unobservable.

Division of takeover gains. To gain control, the bidder must purchase at least half of the target shares by way of a tender offer. The incumbent management is assumed to be unwilling or unable to counterbid; alternatively, it may be part of the investor group that makes the offer to buy out the current shareholders.

Each target shareholder is non-pivotal for the takeover outcome. The consequent free-riding behavior frustrates the takeover unless the bidder has means to "exclude" target shareholders from part of the post-takeover value (Grossman and Hart 1980). We focus on the exclusion mechanism identified by Müller and Panunzi (2004): debt collateralized with target assets. Since debt is senior, shareholders are excluded from future cash flow pledged to the lenders, while the bidder extracts the present value of those cash flows in the form of a loan prior to the bid.

[14] Assuming linear V is without loss of generality since all results can be translated to concave V. Suppose $V : [0, +\infty) \to \mathbb{R}$ is a twice differentiable, strictly increasing, and concave function. The game we consider is isomorphic to a game in which the bidder, instead of choosing e, chooses y where $\theta y = V(e)$. In the latter game, the bidder's post-takeover objective function is $\alpha[\theta y - D]^+ - C(V^{-1}(\theta y))$, where V^{-1} denotes the inverse function of V. Since the inverse of a strictly increasing, strictly concave function is a strictly increasing, strictly convex function, the composition $C \circ V^{-1}$ satisfies the assumptions postulated for C in our model.

Specifically, the bidder is wealth-unconstrained but can nonetheless raise outside funding for the bid in the form of debt and equity. She can choose to pledge a fraction $(1-\gamma) \in [0,1]$ of the cash flow from the acquired target shares to outside investors in exchange for some amount F^E of equity financing. Similarly, she can promise outside creditors a debt repayment $D \geqslant 0$ in exchange for some amount F^D of debt financing. We abstract from exclusion mechanisms other than debt. So a profitable bid requires $F^D > 0$ and that the debt is raised by *bootstrapping*. It is without loss of generality to ignore "non-bootstrapped" debt in our model. We will use the terms "takeover debt" and "bootstrapping" interchangeably.

We assume risk-neutrality and zero discount rates for all players.

Sequence of events. Our model has three stages. In stage 1, the bidder makes a take-it-or-leave-it cash bid to acquire target shares at a price p per share and chooses how to finance the bid. The financing is publicly observable. The bid is conditional, that is, it becomes void if less than half of the shares are tendered.

In stage 2, target shareholders non-cooperatively decide whether to tender their shares. The shareholders are homogeneous and atomistic such that no one is pivotal. Specifically, we assume a unit mass of shares dispersed among an infinite number of shareholders whose individual holdings are equal and indivisible.[15] Shareholder i's tendering strategy maps the offer terms into a probability that she tenders her shares, $\beta_i : (\gamma, D, p) \rightarrow [0,1]$. It is without loss of generality to focus on symmetric strategies and drop index i. So, by the law of large numbers, β shares are traded in a successful bid.

In stage 3, if less than half the shares are tendered, the takeover fails. Otherwise, the bidder pays βp for the fraction β of shares tendered and obtains control. Net of the fraction γ financed by outside investors, the bidder then owns the "inside" equity stake $\alpha \equiv \gamma\beta$, and chooses her effort level $e \geqslant 0$ to maximize her post-takeover payoff

[15] These assumptions are standard in tender offer models exploring the free-rider problem. When they are relaxed, Grossman and Hart (1980)'s result that target shareholders extract all the gains in security benefits becomes diluted (Holmström and Nalebuff 1992).

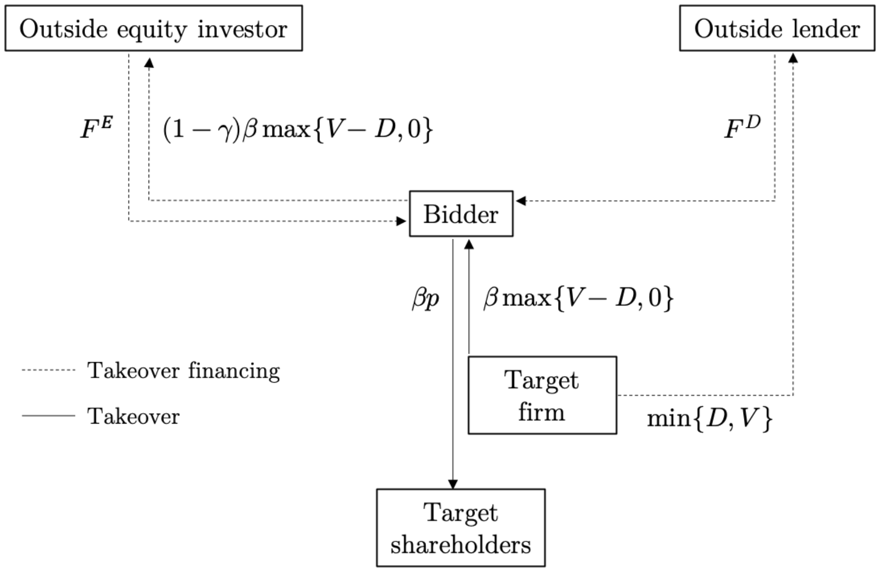

Figure 1: This summarizes the payments vis-à-vis a successful bidder in our model. Consider a management buyout as illustration: Incumbent managers and a buyout firm together are the "bidder," limited partners in the buyout fund are the "outside equity investor," and bondholders or a loan syndicate are the "outside lender." Debt funds being disbursed to the bidder but repaid directly by the target firm is the key effect of bootstrapping.

$U(\alpha, D, e)$. So, her post-takeover strategy is a function $e : (\alpha, D) \rightarrow \mathbb{R}^+$. Finally, the firm value and all payoffs are realized (see Figure 1).

Interpretation An LBO is carried out by a group of investors that may comprise incumbent management and a PE firm, or a consortium of PE firms. These investors take large equity positions in the target and active roles in management or the board (Kaplan and Stromberg 2009, p.130f).[16] They are represented by the "bidder" in our model, whose (cost of) effort hence represents (opportunity costs of) time and effort provided by PE firms, directors, and managers.

PE firms raise equity funding for the buyouts through PE funds. This funding is typically provided by institutional investors, such as pension funds, endowments, and insurance companies (Kaplan and Stromberg 2009, p.123f). These so-called *limited partners*—unlike the PE firms who are known as *general partners*—do not take on an

[16] For PE firms, part of the equity exposure comes from the "carried interest" they earn when their private equity funds perform well. Our model abstracts from this compensation feature.

active role in post-buyout firms. They are the "outside equity investor" in our model.

When a specific buyout deal materializes, PE firms contribute some of the capital from the PE funds as equity to finance the buyout. This equity financing is further complemented with debt financing. The debt makes up the lion's share of the funds, covering 60 to 90 percent of the buyout value (Kaplan and Stromberg 2009, p.124f). The third parties providing the debt funding are the "outside lender" in our model.

Unlike the equity, the debt is raised at *deal* (rather than fund) level. This allows it to be collateralized by the assets of the *target firm* through a bootstrap acquisition. In a first step, a shell company is created and funded from the aforementioned sources of buyout financing to bid for a majority of the target shares. If the bid is successful, the second step is to merge the target with the shell company such that the former's assets are matched with the latter's debt. Consequently, all equity investors receive, in our model notation, parts of $[V(e)-D]^+$. Without the second step, shell company shareholders and target shareholders would, respectively, receive $[\beta V(e) - D]^+$ and $(1-\beta)V(e)$ instead.

The equity stake of the *active* investor group in the merged company is a function of the fraction $1-\gamma$ of outside equity financing and the equity share β tendered by the original target shareholders: $\alpha = \gamma\beta$. With the sole exception of $\alpha = 1$, for every $\alpha < 1$, the roles of β and γ are somewhat interchangeable; though, a given γ imposes a lower bound on α, namely $\alpha \geqslant \gamma/2$, as a successful takeover requires $\beta \geqslant 1/2$.[17] With $\gamma \in [0,1]$, the bidder can implement any $\alpha \in [0,1]$. In going-private buyouts, initial shareholders are bought out ($\beta = 1$); in cash-outs, selling shareholders retain shares in the post-takeover firm ($\beta < 1$). The various cases are subsumed in our model, but distinguishing them is not important as only α matters for our results.

We should note that our model admits takeovers with $\alpha \to 0$. In fact, for $D \to 0$, the optimal α converges to 0. Also, we allow α to be fully optimized at the deal level, while it is in practice to some degree pre-determined by the financial structure of the

[17] This is why constructing α from γ and β matters. Without γ, α has a lower bound of $1/2$. This is counterfactual, and creates a kink at $1/2$ and non-monotonicity, making the model less tractable.

PE funds. These modelling choices are a matter of convenience. Empirically, the median equity stake of the post-takeover management team is about 16 percent (Kaplan and Stromberg 2009), which excludes the ownership stake and carried interest of the PE firms. Our model implication that low debt pushes the optimal α (and hence the value improvement) to 0 is best interpreted to the effect that a buyout without debt is not lucrative.

3.2 Equilibrium

We solve the model by backward induction in three subsections corresponding to the stages of the game. We focus on the bidder's post-takeover stake α and takeover debt D, which characterize the post-takeover ownership and capital structure. Unlike in a standard financing model, there are no wealth constraints that call for outside funds. All effects are purely driven by the interaction between financing choices, tendering decisions, and effort choice.

3.2.1 Effort choice

After a successful bid, the bidder's equity stake is α and the target firm assumes the acquisition debt (of face value) D. The bidder then chooses effort e to maximize the value of her equity stake in the levered firm net of private effort costs, $U(\alpha, D, e) \equiv \alpha[V(e) - D]^{+} - C(e)$.

This objective function is not globally concave in e. Let e_D satisfy $V(e_D) = D$. For $e \in [0, e_D)$, equity is "out of the money" because $V(e) < D$, and so $U(\alpha, D, e) = -C(e)$ which is strictly decreasing in e. For $e \geqslant e_D$, $U(\alpha, D, e) = \alpha[V(e) - D] - C(e)$ since equity is "in the money." Under our assumptions about V and C, this is strictly concave and the first-order condition, $\alpha V'(e) = C'(e)$, has a unique, strictly positive solution, hereafter denoted by $e^{+}(\alpha)$.

Because $U(\alpha, D, e)$ is not globally concave, $e^{+}(\alpha)$ need not be a global optimum. Specifically, given that $\frac{\partial U}{\partial e} < 0$ for $e \in [0, e_D)$, it is possible that $U(\alpha, D, e^{+}(\alpha)) < 0$.

If so, the bidder's optimal effort is $e = 0$. To summarize the above arguments:

Lemma 1. *The bidder's optimal effort is* $e^*(\alpha, D) = e^+(\alpha) > 0$ *if*

$$\alpha[V(e^+(\alpha)) - D] - C(e^+(\alpha)) \geqslant 0 \tag{1}$$

where $e^+(\alpha)$ *is the solution to*

$$\alpha V'(e^+(\alpha)) = C'(e^+(\alpha)) \tag{2}$$

Otherwise, she makes no effort to improve target firm value, i.e., $e^*(\alpha, D) = 0$.

Lemma 1 replicates established wisdom within our takeover setting. Outside debt can lead to a debt overhang that undermines a (controlling) shareholder's incentives to improve firm value (Myers 1977). Here, this occurs when condition (1) is violated. Outside equity dilutes the incentives of "inside" shareholders to increase firm value (Jensen and Meckling 1976). Firm value thus increases in ownership concentration. Indeed, conditional on (1), optimal effort $e^+(\alpha)$ and firm value $V(e^+(\alpha))$ increase in α (by the envelope theorem).

The novel element of Lemma 1 is that these two effects interact in condition (1). Whether a debt overhang problem emerges depends not only on the debt level D but also on the level of ownership concentration α. The intuition is simple: The bidder's incentives derive from a *levered* equity *stake* $\alpha[V(e^+(\alpha)) - D]$. While D lowers the total value of equity, α determines the bidder's share of that total value. As a result, the firm can have more debt without undermining the bidder's incentives if the latter owns more equity. This interaction between α and D will be crucial.

3.2.2 Tendering decisions

As Lemma 1 indicates, the first-best structure is fully concentrated ownership and no debt, i.e., $(\alpha, D) = (1, 0)$.[18] An ideal market for corporate control would restore this structure. We discuss next how free-riding behavior by dispersed target shareholders distorts bidders' preferences regarding α and D.

Suppose target shareholders face a cash bid p (partially) financed with debt D. Being non-pivotal, an individual shareholder i tenders only if $p \geqslant V(e^*(\hat{\alpha}_i, D))$ where $\hat{\alpha}_i$ denotes i's belief about the bidder's post-takeover equity stake. Because tendering decisions depend on individual beliefs, no dominant strategy equilibrium exists. In a rational expectations equilibrium, beliefs are consistent with the outcome, so shareholders tender only if

$$p \geqslant [V(e^*(\alpha, D)) - D]^+. \tag{3}$$

That is, target shareholders tender their shares only if they extract (at least) the full increase in share value that the bidder will generate. This is known as the free-rider condition.

Previous work has analyzed two special cases of (3). Müller and Panunzi (2004) study a model with exogenous post-takeover values where (3) becomes $p \geqslant (V - D)^+$ and show that the bidder maximizes D. Burkart, Gromb, and Panunzi (1998) study a model with endogenous post-takeover values but without debt where (3) reduces to $p \geqslant V(e^*(\alpha, 0))$, and show that the bidder minimizes α. These results, as explained in the papers, share a common logic: the bidder aims to reduce the right-hand side of (3), i.e., the post-takeover share value that target shareholders extract via the price. As we shall see, a model in which D and α are jointly chosen generates novel effects, and overturns some of the key predictions of the aforementioned papers.

Before we characterize the stage-2 subgame equilibrium, note that (3) is merely a

[18] This is the only structure that leads to the first-best outcome for every admissible specification of V and C. For any $D > 0$, there exist admissible V and C such that (1) is violated.

necessary condition for a successful bid; a failed bid, in which an insufficient number of shares is tendered, can always be supported as a self-fulfilling equilibrium outcome. To focus on the interesting case, we assume that shareholders always tender when the free-rider condition is weakly satisfied, thereby selecting the Pareto-dominant success equilibrium whenever it exists.

Denote the post-takeover share value that the bidder will create for a given stake α and debt D by $E(\alpha, D)$ and her *equilibrium* post-takeover equity stake by $\alpha^*(p, D)$. Since a successful bid implies that $\beta \in [1/2, 1]$ shares are tendered, the bidder's post-takeover stake α lies in the interval $[\gamma/2, \gamma]$ for a given outside equity financing share $1 - \gamma$. Hence, the post-takeover share value must lie between $E(\gamma/2, D)$ and $E(\gamma, D)$. In the subsequent lemma, we omit describing the subgame equilibrium for bids that can be ruled out a priori: bids that fail for any set of beliefs ($p < E(\gamma/2, D)$) and bids that could be undercut without affecting any other decision ($p > E(\gamma, D)$).

Lemma 2. *Any bid $p \in [E(\gamma/2, D), E(\gamma, D)]$ succeeds, and $\alpha^*(p, D) = \alpha_p$ where α_p satisfies $p = E(\alpha_p, D)$.*

Proof. For every $p \in [E(\gamma/2, D), E(\gamma, D)]$, there exists a unique $\alpha_p \in [\gamma/2, \gamma]$ such that $E(\alpha_p, D) = p$. Every shareholder tenders for $\hat{\alpha}_i < \alpha_p$, retains her shares for $\hat{\alpha} > \alpha_p$, and is indifferent between tendering and retaining for $\hat{\alpha} = \alpha_p$. □

Target shareholders are willing to sell shares until the post-takeover share value, which increases with the bidder stake, matches the bid price. As in Burkart, Gromb, and Panunzi (1998), supply is hence upward-sloping: the fraction of shares tendered increases with the price. In equilibrium, the bidder ends up with the stake for which the free-rider condition (3) holds with equality.[19]

[19]Though the outcome is pinned down, the equilibrium strategy profile is not necessarily unique. The outcome obtains when each shareholder tenders with probability $\beta_p \equiv \alpha_p/\gamma$, but also when mass β_p of shareholders tenders with certainty while all others keep their shares.

3.2.3 Bid and financing

The bidder's ex ante profit is $\alpha E(\alpha_p, D) - \beta p - C(e) + F^E + F^D$. It comprises the value of the equity stake she expects to acquire, less effort cost and takeover payment, and outside funds she raises for the bid. She maximizes this by choosing the bid p, outside equity financing $\{\gamma, F^E\}$, and debt financing $\{D, F^D\}$ subject to (1), (2), (3), and the following participation constraints: Outside equity investors demand

$$F^E \leqslant \beta(1-\gamma)E(\alpha_p, D). \tag{4}$$

Outside lenders demand $F^D \leqslant \min[D, V(e)]$. Since debt overhang constraint (1) requires $V(e) > D$, this reduces to

$$F^D \leqslant D. \tag{5}$$

We assume perfect competition among outside financiers such that they merely break even. Hence, (4) and (5) hold with equality. Substituting these binding participation constraints in the bidder's ex ante profit yields $\beta[E(\alpha, D) - p] - C(e) + D$.

Recall from Lemma 2 that free-rider condition (3) is endogenously binding; target shareholders tender α_p shares such that $E(\alpha_p, D) = p$. Recall further from Lemma 1 that, conditional on (1), post-takeover effort is $e^+(\alpha)$, which satisfies (2). To demarcate the new element of our analysis from existing results, we first state how these constraints—binding free-rider condition (3) and first-order condition (2) for effort—affect the bidder. Plugging these constraints into her ex ante profit gives

$$D - C(e^+(\alpha)). \tag{6}$$

This replicates the known insights that debt D enables the bidder to extract private gains and that a larger equity stake α is unattractive because it induces her to incur higher effort costs, while all gains in share value accrue to target shareholders. This also shows that the bidder's ex ante problem essentially reduces to choosing the post-takeover ownership and capital structure (α, D).[20]

The new element is the joint restriction that debt overhang constraint (1) imposes on D and α. This constraint cannot be slack at the optimum. Otherwise, the bidder could lower α while preserving D. This would increase her profit, as (6) shows. Using the binding constraint (1) to replace D in (6) collapses the bidder's stage-0 choices to a univariate optimization problem:

$$\max_{\alpha \in [1/2, 1]} V(e^+(\alpha)) - C(e^+(\alpha)) - \frac{C(e^+(\alpha))}{\alpha}. \tag{P}$$

In Section 4, we use this representation of the problem to study the role of debt. Before doing so, we conclude this section by establishing equilibrium existence (though not uniqueness).

Lemma 3. *If the bidder's profit under (P) is negative, she makes no bid. Otherwise, she succeeds with a bid such that (1)-(5) bind and α solves (P).*

Proof. The objective function is continuous in α and its domain is compact. Hence there exists an $\alpha \in [1/2, 1]$ that solves (P). If the profit under this solution is positive, the bidder makes a successful bid. Otherwise, she abstains from a takeover. □

4 Social Value of Bootstrapping

This section presents our main results. For their interpretation, it is worth repeating that we abstract from wealth constraints; the bidder can restore first-best incentives by fully self-financing the takeover—no need for debt. What keeps her from doing so are frictions in the takeover process. Our results speak to how financing impacts this process, and not only the resultant capital structure, making this a theory of *takeover*

[20]This is why it is without loss of generality to abstract from cash-equity bids and restricted bids. The same objective function obtains (i) for cash-equity bids with $1 - \alpha$ being the fraction of post-takeover equity offered to target shareholders as payment combined with cash or (ii) for cash bids in which the number of shares the bidder offers to acquire is restricted to α.

debt.

4.1 Ownership-leverage relationship

We begin by considering the effect of bootstrapping on takeover surplus. The surplus created by a successful takeover in our model is $\mathcal{W}(\alpha) \equiv V(e^{+}(\alpha)) - C(e^{+}(\alpha))$. While this expression depends only on the bidder's post-takeover equity stake α, the latter is linked to debt D through debt overhang constraint (1), which binds in equilibrium. Solving the binding constraint for D yields

$$D = V(e^{+}(\alpha)) - \frac{C(e^{+}(\alpha))}{\alpha}. \tag{1*}$$

As shown in the proof of the next result, (1*) defines D as a monotonically increasing function of α. The intuition behind this *ownership-leverage function* is that, to avoid debt overhang, a higher debt level D requires a larger bidder stake α.[21] The latter, in turn, leads to a higher surplus $\mathcal{W}(\alpha)$.

Proposition 1. *Bootstrapping increases takeover surplus.*

Proof. Section B of the Appendix. □

This result is not obvious as the primary purpose of bootstrapping is to shift rents from target shareholders to bidders. In Müller and Panunzi (2004), conditional on a bid, bootstrapping is a pure transfer, and inefficient for exogenous bankruptcy costs. The interaction of the free-rider problem with the incentive problem is key to Proposition 1.

On the equity side, the fact that owning a larger stake creates stronger incentives to create value is a *dis*incentive to buy shares when faced with the free-rider problem. While the bidder is more incentivized to provide effort when acquiring a larger stake,

[21] The inverse interpretation is that takeover debt makes bidders willing to buy larger stakes. We primarily use the first interpretation in light of the bidder's profit function (6), whereby she would at the margin want to increase D and decrease α (were it not for debt overhang constraint (1*)).

target shareholders appropriate the added value through the bid price. All else equal, the bidder hence prefers low α.

On the debt side, lenders' willingness to provide funds hinges on how much value they expect to be generated. To raise more debt, the bidder must commit to generate more value. Buying a larger stake is that commitment, as reflected in the ownership-leverage function. When she uses debt, this need for commitment prevails over her preference for low α. A legal restriction on bootstrapping or buyout leverage, would impede this indirect benefit of bootstrapping on incentives.

This qualifies the prediction in Burkart, Gromb, and Panunzi (1998) that bidders buy as little equity as needed to gain control when value creation is endogenous, and replaces it with the following result: Bootstrapping drives equity consolidation. It is known that, after buyouts, managers have more equity and boards are dominated by active owners (Kaplan 1989). Our theory predicts that lenders supply more takeover debt if such post-buyout insiders acquire more equity and vice versa. We are unaware of empirical evidence that speaks directly to this prediction.[22]

Some evidence in another context is in line with the ownership-leverage function, which is a key part of the prediction. Anderson, Mansi, and Reeb (2003) report that founding family ownership in large, public firms is related to a lower cost of debt and argue that this is due to reduced debt-equity conflict. Lagaras and Tsoutsoura (2015) find similar results in a natural experiment and document that, for 17% of the family firms, creditors require that the founding family maintain a minimum percentage of ownership or voting power.[23]

[22]This prediction is about a causal effect: for a *given* buyout, insiders buy less equity if leverage or bootstrapping is restricted, or conversely, lenders provide less financing if insider equity is reduced. This need not imply a positive correlation between buyout debt and post-buyout insider ownership in the cross-section of buyouts (owing to, possibly unobserved, differences in V and C across deals). Testing the prediction faces some difficulties: it is challenging to isolate the causal effect; identifying all post-buyout "insiders" and measuring their equity exposures (incl. options and carried interest) is not straightforward; and some data may be aggregated at the PE fund level.

[23]These studies suggest that family ownership makes it easier for a firm to raise (more) debt. The part of the intuition behind Proposition 1 that is missing in the context of those papers is that the bidders in our model have strong incentives to lever up: they need debt to extract takeover gains.

4.2 Debt constraint as sharing rule

We now study how the surplus $\mathcal{W}(\alpha)$ is split between bidder and target shareholders. This too is determined by the ownership-leverage function (1*). It implies an equity value of $V(e^+(\alpha)) - D = \frac{C(e^+(\alpha))}{\alpha}$. Writing the bidder's profit in (P) as

$$\mathcal{W}(\alpha) - \frac{C(e^+(\alpha))}{\alpha},$$

we see that it equals the total surplus less the equity value target shareholders extract through the bid price, due to the free-rider problem. In our model, this equity value is the wedge the bidder must leave between firm value and debt to avoid debt overhang, i.e., $\frac{C(e^+(\alpha))}{\alpha}$ by (1*). How this varies with α determines how increases in $\mathcal{W}(\alpha)$ induced by bootstrapping are split between bidder and target shareholders.

There are two opposing effects. Holding the numerator fixed, $\frac{C(e^+(\alpha))}{\alpha}$ decreases in α. This reflects that blockholder incentives depend on equity concentration and total equity value: active shareholders with larger stakes can dilute total equity value more without creating debt overhang problems.

However, holding the denominator fixed, $\frac{C(e^+(\alpha))}{\alpha}$ increases in α through $C(e^+(\alpha))$. That is, the increase in equilibrium effort moderates dilution. If the bidder acquires a larger equity stake as an incentive to improve firm value more, any parallel increase in debt must not undermine the required higher effort.

Target shareholders benefit from bootstrapping when the latter effect dominates. This requires equilibrium effort $e^+(\alpha)$ to be sufficiently elastic, which in turn requires that the cost function is not *too* convex. The next result states a sufficient condition for this to be the case.[24]

Proposition 2. *If the cost function C is log-concave, bootstrapping increases takeover*

[24]The condition (log-concavity) is not very restrictive and met by, among others, power functions $C(e) = \frac{c}{n}e^n$ and exponential functions $C(e) = \exp(e) - c$. It is tighter than needed; for example, target shareholders can benefit even if C is not *globally* log-concave. When C becomes too convex, the limit $e^{+\prime}(\alpha) \to 0$ is a model with exogenous costs and values (Müller and Panunzi 2004). If we allow concave value improvement functions, an analogous condition exists for the concavity of the bidder's post-takeover objective function.

premia.

Proof. Section C of the Appendix. □

In Müller and Panunzi (2004), bootstrapping is a zero-sum transfer that strictly reduces takeover premia. Target shareholders would thus benefit from restrictions on bootstrapping or leverage. This is a general rule in the theory of tender offers: target shareholders prefer some limits to exclusion, even if those deter some takeovers, as it redistributes takeover gains to the bidder. Proposition 2 identifies, as far as we know, the only exception to the rule. Under the stated condition, target shareholders do not want *any* restriction on bootstrapping or takeover leverage.

More than of theoretical interest, Proposition 2 squares the idea of bootstrapping as rent extraction with empirically high target returns in LBOs (e.g., Jensen 1988). (Appendix E.1 has examples of V and C functions where high leverage ratios benefit target shareholders.) In Section 4.4, we show that bidding competition reinforces the positive link between bootstrapping and target returns.

Like Proposition 1, Proposition 2 is a consequence of endogenous value creation. The crux is that the incentive problem constrains debt—but this plays a different role than in standard financing theories where the constraint measures up against a need for outside funds. Here it determines what a bidder can extract from the takeover, or conversely, has to leave on the table for free-riding target shareholders, for a given α. Intriguingly, the incentive constraints on D impose a "sharing rule" for the incentive gains from α such that bootstrapping can be *Pareto*-improving.

4.3 Negative financing contribution

It is instructive to spell out in what form the surplus $\mathcal{W}$ is paid out to the bidder and target shareholders. (Outside investors just break even.) Target shareholders receive the full share appreciation $V - D$ on any shares they retain *or sell*. But how does the bidder make a profit if target shareholders get the full appreciation on all sold shares? It can only be that she does not fully pay for her stake out of her own pocket.

In our model, a bidder's financing portion is $I_B \equiv \beta(V-D) - F^E - F^D$, where $\beta(V-D)$ is the total takeover payment, F^E is outside equity funding, and F^D is debt funding. The latter two are given by (4) and (5), which are binding in equilibrium, as $F^E = \beta(1-\gamma)(V-D)$ and $F^D = D$. Netting out outside equity, we get $I_B = \alpha(V-D) - D$ where $\alpha(V-D)$ is what the shares that go to the bidder are worth. Takeover debt lets her pay less than the value of the stake she gets. In fact, in equilibrium, she actually does not pay in, but *is paid out*, cash upfront.

Proposition 3. *The bidder's financing contribution is negative.*

Proof. By (1*), $I_B = C(e^+(\alpha)) - D$, which is the negative of bidder profit (6). □

Recall that the bidder uses debt D to dilute the post-takeover share value $V-D$. But she cannot fully dilute it as debt overhang would undermine post-takeover effort. In equilibrium, under binding debt overhang constraint (1*), the value of her stake in the diluted equity exactly covers her effort cost: $\alpha(V(e^+(\alpha))-D) = C(e^+(\alpha))$. Thus, the takeover is not "worth her effort" unless she gets that equity stake *for free*, which requires that the debt funding covers its full price. For strictly positive bidder profits, the debt funding must *exceed* the price of her stake, thus "financing" upfront payouts (e.g., fees to the PE firm).

Note that the bidder's remuneration consists of two components: (i) target equity that she receives for free, akin to stock compensation, which incentivizes her to incur the effort that outside financiers bank their participation on; and (ii) an upfront cash payment, akin to a fixed salary, that is equal to her equilibrium rent. LBO financing resembles a compensation contract through which the passive LBO (debt and equity) investors "hire" bidders to take over the management of the target firms; and bidders profiting despite contributing no capital is analogous to managers earning returns to human capital.

Legal restrictions on bootstrapping or takeover leverage would restrict how much bidders cash out upfront, but by Proposition 1, also how much surplus they generate.

That is, upfront payouts are a sign of efficiency. Last, note that Proposition 3 implies that wealth constraints would be slack in our model.

4.4 Leveraging competition

In the last part of our analysis, we consider two competing bidders who may differ in their value improvement or cost functions. We use subscripts, 1 and 2, to associate a function or variable with a bidder. To gain control of the target, a bidder must outbid her rival with an offer that satisfies the free-rider condition. We establish two results: (i) bootstrapping raises their reservation prices and (ii) the winner's use of takeover debt increases with the loser's reservation price.

4.4.1 Bootstrapping increases reservation prices

Without loss of generality, consider bidder 2. Also in the extension with competition, if she succeeds, her effort will satisfy first-order condition (2) and target shareholders will tender such that free-rider condition (3) strictly binds (Sections 3.2.1 and 3.2.2). As a result, (6) still applies; bidder 2's profit can be written as $D_2 - C_2(e_2^+(\alpha_2))$.

We can characterize all offers under which bidder 2 would break even by

$$D_2 = C_2(e_2^+(\alpha_2)). \tag{7}$$

By definition, target shareholders receive the whole surplus under a break-even offer; so the break-even prices are equal to $\mathcal{W}_2(\alpha_2)$. As $\mathcal{W}_2(\alpha_2)$ is strictly increasing, bidder 2's reservation price $\overline{p}_2$ is the break-even price under the largest (α_2, D_2) that is both feasible and satisfies (7), hereafter denoted by $(\overline{\alpha}_2, \overline{D}_2)$.

To highlight the importance of bootstrapping for bidder 2's reservation price, take an exogenous debt limit $\overline{\overline{D}}_2$. If $\overline{\overline{D}}_2 < \overline{D}_2$, the limit reduces her reservation price from $\mathcal{W}_2(\overline{\alpha}_2)$ to $\mathcal{W}_2(\overline{\overline{\alpha}}_2)$ where $\overline{\overline{\alpha}}_2$ solves (7) for debt level $\overline{\overline{D}}$. As α_2 and D_2 are positively related in (7), this means that a limit on takeover debt reduces the reservation price, making bidder 2 a "weaker" competitor.

Proposition 4. *Bootstrapping strengthens competition.*

It is worthwhile repeating that neither bidder is wealth-constrained. That is, the role of debt financing here is not that it makes it *possible* to pay more. Rather, its role in break-even condition (7) is to compensate bidder 2 for costs. Being able to recoup costs drives how much value she is *willing* to generate, which in turn determines her reservation price.

4.4.2 Competition promotes bootstrapping

Without loss of generality, consider bidder 1. To show that she uses more debt under competition, we first show that she does not exhaust her debt capacity otherwise. In the absence of competition, she maximizes (6) subject to (1*), that is, solves

$$\max_{\alpha_1 \in [0,1]} D_1(\alpha_1) - C(e_1^+(\alpha_1)), \tag{8}$$

where $D_1(\alpha_1)$ is her ownership-leverage function defined by (1*). Her maximum debt capacity, by contrast, is found by maximizing α_1 subject to $D_1(\alpha_1) - C(e_1^+(\alpha_1)) = 0$ or is the corner value $D_1(1)$. Hence, whenever the solution to (8) involves $\alpha_1^* < 1$ and a strictly positive profit, bidder 1 raises less debt than she *could*. This is, for example, always the case when C is from the class of power functions (see Appendix E.1).[25]

Lemma 4. *Absent competition, bidders do not generally exhaust their debt capacity.*

Intuitively, this is a consequence of Proposition 2: If target shareholders capture part of the incentive gains induced by bootstrapping, bidders will not generally max out on debt. This begs the question how they adjust debt in response to competition.

[25] In incentive models with wealth constraints (e.g., Innes 1990), the insider always ends up with all the equity ($\alpha = 1$). In those models, swapping outside debt for outside equity raises incentives and pledgeable income; such a swap is always feasible and profitable. For real-world LBOs by PE firms, it is safe to claim that $\alpha < 1$ due to the large capital contributions of limited partners.

Hereafter, let bidder 1's bid $(\alpha_1^*, D(\alpha_1^*), p_1^*)$ absent competition be strictly profitable with $\alpha_1^* < 1$, so she has unused debt capacity.

Without loss of generality, let bidder 1 have the higher reservation price and win. Under competition, her optimal bid meets four conditions: debt overhang constraint (1), first-order condition (2) for effort, free-rider condition (3), and furthermore the competition constraint:

$$p_1 \geqslant \overline{p}_2 \tag{9}$$

We assume $\overline{p}_2 > p_1^*$, so competition is effective.

Suppose her optimal bid just matches bidder 2's reservation price, so (9) binds.[26] Focusing on interior solutions, where bidder 1 gets $\alpha_1 < 1$ shares, recall from Lemma 2 that free-rider condition (3), endogenously, binds. (We cover corner solutions in the proof of the next result.) Substituting (2) and a binding (9) into a binding (3) yields

$$D_1 = V(e_1^+(\alpha_1)) - \overline{p}_2. \tag{10}$$

This identifies (α_1, D_1) that take into account all optimality conditions except for (1). With target shareholders' payoff fixed at $\overline{p}_2$, bidder 1's profit subject to (10) is

$$\mathcal{W}_1(\alpha_1) - \overline{p}_2.$$

As this strictly increases in α_1, bidder 1 should match $\overline{p}_2$ with the highest α_1 subject to (10) and (1). Intuitively, if limiting target shareholders to $\overline{p}_2$ ((9)), she optimally maximizes surplus under the other constraints. This requires increasing α to improve incentives to create value ((2)) and increasing D to keep post-takeover share value at $\overline{p}_2$ (due to (3))—until further increases are infeasible due to debt constraints ((1)) or because the corner solution is reached ($\alpha_1 = 1$).

One can show that this reasoning implies the next result which, in keeping with

[26] Since the objective function in (P) can be non-monotonic in α, it is possible that bidder 1 wants to pay *strictly* more than $\overline{p}_2$. The arguments that follow in the text can also be applied to such cases with $\overline{p}_2$ replaced by $\overline{p}_2^+ = \overline{p}_2 + \Delta$ for some $\Delta > 0$.

the language of Proposition 4, refers to an increase in $\overline{p}_2$ as "stronger" competition.

Proposition 5. *Stronger competition increases bootstrapping and takeover surplus.*

Proof. Section D of the Appendix. □

Both parts of Proposition 5 are novel. In Müller and Panunzi (2004), where post-takeover values are exogenous, competition curbs bootstrapping. In incentive models with wealth constraints, competition increases bidders' need for outside funds, which pushes them further *away* from first-best incentives. In our model, bidders generally do not increase their own incentives as much as feasible due to the free-rider problem. Competition pushes them *toward* first-best incentives, and as they create more value, they also extract more through debt.

The effect of competition on profits is the conventional one: The added constraint (9) lowers bidder profits. Given takeover surplus increases, target shareholders gain. Proposition 5 thus reconciles bidding competition with high takeover leverage as well as high takeover leverage with low bidder returns, in line with the following narrative (Holmstrom and Kaplan 2001, p.128f):

> The leveraged buyout experience was different in the latter half of the 1980s. Roughly one-third of the leveraged buyouts completed after 1985 subsequently defaulted on their debt, some spectacularly...But even for the late 1980s, the evidence is supportive of the efficiency story ...
>
> The likely answer is that the success of the LBOs of the early 1980s attracted entrants and capital... As a result, much of the benefit of the improved discipline, incentives, and governance accrued to the selling shareholders rather than to the post-buyout LBO investors. The combined gains remained positive, but the distribution changed.

At the extreme in our model, if the bidders are equally competitive, the winner raises her maximum feasible debt amount but *all* of the surplus goes to target shareholders —even though the debt serves to dilute the latter.

To summarize Propositions 4 and 5: Bootstrapping makes rival bidders stronger, and this forces winners to use more takeover debt, which is both efficient and benefits target shareholders. These pro-competitive effects of debt in our model contrast with existing theories. In Chowdhry and Nanda (1993), debt serves to *deter* competition. Extending results from Hansen (1985) and Rhodes-Kropf and Viswanathan (2000), DeMarzo, Kremer, and Skrzypacz (2005) show that competing bidders prefer to pay in cash rather than equity, or equivalently, prefer debt to equity financing because it *reduces* the seller's expected revenue.

5 Conclusion

The question of why firms use debt and how much they should use is one of the classic questions in finance. Much is by now understood, but the question still sparks debate in areas where leverage seems "excessive," such as in LBOs. During the buyout wave in the 1980s, then-SEC Chairman Alan Greenspan cautioned in U.S. Senate hearings (Leveraged Buyouts and Corporate Debt 1989, p.17),

> [T]he extent of the leverage involved is worrisome, in the sense that while one may say the restructuring is a plus, how it is financed is a different question and something which I find disturbing . . . If, for example, all of this restructuring were done with equity, rather than leveraged buyouts, I frankly would feel considerably more comfortable.

The prevailing narrative is that leverage optimizes the incentives with which the targets are managed *after* the buyout. While persuasive, this leaves some questions open: If implementing optimal capital structure, why are leverage ratios in buyouts so much *higher* than in firms, sometimes reaching 90 percent of total capital? If debt serves to discipline and incentivize those who control the post-takeover firms, why do PE firms raise it in such a manner as to *eschew* liability ("bootstrapping")? These questions stir up suspicion that the debt has a less benign purpose. With PE activity expanding, such criticism is resurfacing (Kosman 2009; Appelbaum and Batt 2014), echoing Greenspan's unease.

In this paper, we offer answers to these questions by merging the incentive theory of buyouts with the theory on the free-rider problem in takeovers of widely held firms. Our unified theory predicts "*excessive*" levels of debt (beyond financing needs) raised through *bootstrapping* as a *Pareto*-improving financing structure. As far as we know, it is the only theory to fully capture these characteristics of LBO financing.

The role of bootstrapping identified in our theory can be seen as a capstone on a well-known strand of thought in corporate governance theory. Set against Berle and Means (1932)'s classic paradigm that dispersed ownership leads to agency problems, Manne (1965) proposed perhaps the most direct remedy: (the threat of) takeovers as a means to reunify ownership and control whenever warranted. Such a takeover has to (re)concentrate ownership to *improve incentives* (Jensen and Meckling 1976) while *overcoming the free-rider problem* among the dispersed shareholders (Grossman and Hart 1980). What we show is that bootstrapping the target (to such a degree that PE firms can cash out early) is an efficient takeover design that achieves both of these objectives simultaneously, immune even from the caveat that the target shareholders usually want to impose a limit on the mechanism bidders use to extract gains.

Our theory does not refute that LBO financing could have a dark side, such as a higher risk of financial distress or negative externalities on other stakeholders. But it offers efficiency arguments for controversial LBO traits to counterbalance some of the concerns. In fact, it argues that bootstrapping is crucial to a well-functioning market for corporate control, and can explain why buyouts are extremely leveraged based on arguments that do not apply outside of takeovers.

Appendix

A Auxiliary results

For reference, we state the following result from one variable calculus (e.g., Rudin (1964, p. 114)):

Lemma A.1. *Let $f : (0, +\infty) \to \mathbb{R}$ be a differentiable function such that $f'(x) > 0$ for all $x \in (0, +\infty)$. Then f is strictly increasing on $(0, +\infty)$ and has a differentiable inverse function g with*

$$g'(f(x)) = \frac{1}{f'(x)}$$

for all $x \in (0, +\infty)$. If $f : (0, +\infty) \to \mathbb{R}$ is twice differentiable and such that $f''(x) > 0$ for all $x \in (0, +\infty)$ then its inverse g is also twice differentiable and we have

$$g''(f(x)) = -\frac{f''(x)}{(f'(x))^3}$$

for all $x \in (0, +\infty)$.

We now derive two auxiliary results.

Lemma A.2. *There is a unique differentiable function $e : [1/2, 1] \to \mathbb{R}_{\geqslant 0}$ such that $\alpha V'(e(\alpha)) = C'(e(\alpha))$ for all $\alpha \in [1/2, 1]$ and such that $e'(\alpha) > 0$ for all $\alpha \in (1/2, 1)$. If moreover $C'''(e)$ exists for all $e > 0$, then e is twice differentiable.*

Proof. Define a function $H : (0, +\infty) \to \mathbb{R}$ by $H(e) = \frac{C'(e)}{\theta}$. Clearly

$$H'(e) = \frac{C''(e)}{\theta} > 0$$

for all $e > 0$ by our assumption that $C''(e) > 0$ for all $e \geqslant 0$. Thus H satisfies the premises of Lemma A.1, and hence there is a differentiable function G such that $G(H(e)) = e$ for all $e > 0$ and $H(G(y)) = y$ for all y in the range of H. From our assumptions $\lim_{e \to 0} C'(e) = 0$ and $\lim_{e \to +\infty} C'(e) = +\infty$ and the fact that H is continuous, it follows that $[1/2, 1]$ is a subset of the range of H, i.e.,

$[1/2, 1] \subseteq H((0, +\infty))$. Hence we may define $e : [1/2, 1] \to (0, +\infty)$ by $e(\alpha) := G(\alpha)$ for all $\alpha \in [1/2, 1]$. Then $\frac{C'(e(\alpha))}{\theta} = H(e(\alpha)) = H(G(\alpha)) = \alpha$ for all $\alpha \in [1/2, 1]$ and the first part of the claim follows. Let $\alpha \in (1/2, 1)$ and $e > 0$ be such that $H(e) = \alpha$, applying Lemma A.1 once again then yields

$$e'(\alpha) = e'(H(e)) = \frac{1}{H'(e)} = \frac{\theta}{C''(e)} > 0.$$

Moreover if C is thrice differentiable we have that

$$e''(\alpha) = e''(H(e)) = -\frac{H''(e)}{(H'(e))^3} = -\theta^2 \frac{C'''(e)}{[C''(e)]^3}.$$

□

B Proof of Proposition 1

Equation (1*) defines the equilibrium debt level $\overline{D}(\alpha) \equiv V(e^+(\alpha)) - \frac{C(e^+(\alpha))}{\alpha}$. Now,

$$\begin{aligned}
\overline{D}'(\alpha) &= V'(e^+(\alpha))e^{+\prime}(\alpha) + \frac{1}{\alpha^2}C(e^+(\alpha)) - \frac{1}{\alpha}C'(e^+(\alpha))e^{+\prime}(\alpha) \\
&= \big(V'(e^+(\alpha)) - \frac{1}{\alpha}C'(e^+(\alpha))\big)e^{+\prime}(\alpha) + \frac{1}{\alpha^2}C(e^+(\alpha)) \\
&= \frac{1}{\alpha^2}C(e^+(\alpha)) > 0.
\end{aligned}$$

The third equality holds because $\alpha V'(e^+(\alpha)) - C'(e^+(\alpha)) = 0$ by (2). The fact that $\overline{D}(\alpha)$ is strictly increasing implies the same for its inverse function. Last, note that $\mathcal{W}(\alpha)$ is strictly increasing in α with the first-best outcome being attained for $\alpha = 1$.

C Proof of Proposition 2

Target shareholder gains. Target shareholders benefit from higher α if

$$\frac{\mathrm{d}}{\mathrm{d}\alpha}\frac{C(e^+(\alpha))}{\alpha} = \frac{C'(e^+(\alpha))e^{+\prime}(\alpha)}{\alpha} - \frac{C(e^+(\alpha))}{\alpha^2}$$

$$= \frac{\theta}{\alpha}\left[\frac{C'(e^+(\alpha))}{C''(e^+(\alpha))} - \frac{C(e^+(\alpha))}{C'(e^+(\alpha))}\right] \geqslant 0.$$

The second equality holds by Lemma A.1, whereby if $e^+(\alpha) > 0$, then $e^{+\prime}(\alpha) = \frac{\theta}{C''(e^+(r))}$. A sufficient condition for the inequality to hold (globally) is log-concavity of C, i.e., $C(e)C''(e) \leqslant [C'(e)]^2$ for all $e > 0$. Power functions satisfy this property, as do exponential functions (though only weakly).[27]

Bidder gains. The bidder's profit, $\pi^B(\alpha) \equiv V(e^+(\alpha)) - \left[1 + \frac{1}{r}\right] C(e^+(\alpha))$, is strictly increasing in α if

$$\begin{aligned}
\frac{\mathrm{d}\pi^B(\alpha)}{\mathrm{d}\alpha} &= V'(e^+(\alpha))e^{+\prime}(\alpha) + \frac{1}{\alpha^2}C(e^+(\alpha)) - \frac{1}{\alpha}C'(e^+(\alpha))e^{+\prime}(\alpha) - C'(e^+(\alpha))e^{+\prime}(\alpha) \\
&= \left[V'(e^+(\alpha)) - \frac{1}{\alpha}C'(e^+(\alpha))\right]e^{+\prime}(\alpha) + \frac{1}{\alpha^2}C(e^+(\alpha)) - C'(e^+(\alpha))e^{+\prime}(\alpha) \\
&= \frac{1}{\alpha^2}C(e^+(\alpha)) - C'(e^+(\alpha))e^{+\prime}(\alpha) \\
&= \frac{1}{\alpha^2}C(e^+(\alpha)) - \frac{C'(e^+(\alpha))\theta}{C''(e^+(\alpha))} \\
&= \frac{1}{\alpha^2}C(e^+(\alpha)) - \frac{C'(e^+(\alpha))C'(e^+(\alpha))}{C''(e^+(\alpha))\alpha} \\
&= \frac{1}{\alpha}\left(\frac{C(e^+(\alpha))}{\alpha} - \frac{[C'(e^+(\alpha))]^2}{C''(e^+(\alpha))}\right) > 0
\end{aligned}$$

The second equality is obtained by rearranging terms. The third equality holds since $\alpha V'(e^+(\alpha)) - C'(e^+(\alpha)) = 0$ by (2). The fourth equality follows from Lemma A.2. The fifth equality holds because $\alpha\theta = C'(e^+(\alpha))$ by (2). A sufficient condition for the last inequality to be satisfied (globally) is that

$$\frac{1}{\alpha}\left(\frac{C(e)}{\alpha} - \frac{[C'(e)]^2}{C''(e)}\right) > \frac{1}{\alpha}\left(C(e) - \frac{[C'(e)]^2}{C''(e)}\right) \geqslant 0$$

for all $e > 0$. The strict inequality holds for all $\alpha < 1$. The last weak inequality holds if C is log-convex, i.e., if $C(e)C''(e) \geqslant [C'(e)]^2$ for all $e > 0$. Exponential functions

[27] Note that $\frac{C(e^+(\alpha))}{\alpha}$ is an average cost per share, but α is not the direct argument in C. If C were a *direct* function of α, a sufficient condition for the average cost to be increasing is that marginal cost exceeds average cost. Log-concavity matters for first-order condition (2) to ensure that $e^+(\alpha)$ is sufficiently elastic with respect to α.

satisfy this property.

Appendix E uses the two families of functions identified above as examples. It is worth emphasizing that the above sufficient conditions, which the examples satisfy, are stronger than needed for Pareto improvements to be feasible.

D Proof of Proposition 5

Interior solution. Note that (10) expresses bidder 1's debt as a strictly increasing function of her equity stake. We denote this function by

$$D_1^c(\alpha_1) \equiv V(e_1^+(\alpha_1)) - \overline{p}_2.$$

It represents (α_1, D_1) that take into account all optimality conditions except (1), or more specifically, for which (2) holds and (3) and (9) strictly bind.

Recall that, as per (1*),

$$D_1(\alpha_1) \equiv V_1(e_1^+(\alpha_1)) - \frac{C_1(e_1^+(\alpha_1))}{\alpha_1}$$

represents all (α_1, D_1) for which (1) strictly binds.

As established in the main text, bidder 1 optimally matches bidder 2's reservation price by maximizing α subject to (1) and (10). The solution is the highest α_1 where

$$D_1^c(\alpha_1) \leqslant D_1(\alpha_1),$$

which we hereafter denote by α_1^{**}.

The previous inequality is slack at the single-bidder optimum α_1^*:

$$D_1^c(\alpha_1^*) = V_1(e^+(\alpha_1^*)) - \overline{p}_2 < V_1(e^+(\alpha_1^*)) - p_1^* = D_1(\alpha_1^*),$$

where the inequality follows from $p_1^* = \frac{C_1(e_1^+(\alpha_1^*))}{\alpha_1^*}$ and effective competition ($\overline{p}_2 > p_1^*$).

Thus, $\alpha_1^{**} > \alpha_1^*$. That is, competition increases bidder 1's takeover debt compared to the single-bidder case.

For a given $\overline{p}_2$, suppose $\alpha_1^{**} < 1$. Does bidder 1 use even more takeover debt when bidder 2's reservation price increases to $\overline{p}_2^\epsilon > \overline{p}_2$? One can show that this is the case by relabeling α_1^{**} as α_1^*, $\overline{p}_2$ as p_1^*, and $\overline{p}_2^\epsilon$ as $\overline{p}_2$ and retracing the previous arguments. In doing so, an important observation is that debt overhang constraint (1) binds for any optimal non-corner winning bid; for $\alpha_1^{**} < 1$, $D_1^c(\alpha_1^{**}) = D_1(\alpha_1^{**})$.

Corner solution. Suppose bidder 1 matches bidder 2's reservation price with a bid that leads to $\alpha_1 = 1$. At $\alpha_1 = 1$, the free-rider condition can be slack. Still, as bidder 1 buys all shares at a price equal to $\overline{p}_2$, her profit is $\mathcal{W}(1)-\overline{p}_2$, which is the maximum value of the profit function $\mathcal{W}(\alpha) - \overline{p}_2$ used in the arguments in the text. Thus, the result that bidder 2's presence increases bidder 1's takeover debt, if $\alpha_1^* < 1$, is valid also when the winning bid is a corner solution. Once in the corner solution, bidder 1 can meet further increases in $\overline{p}_2$ by reducing debt but, equivalently, also by raising p_1 without a change in debt.

E Examples

Example E.1 (Power functions)**.** Let $V(e) \equiv \theta e$ and $C(e) \equiv \frac{c}{n}e^n$ where $\theta > 0$, $c > 0$ and $n \in \mathbb{N}$ are exogenous parameters. These functions satisfy all our assumptions. It can also be shown that they generate unique solutions to (P) (proof available upon request). So, if the bidder's profit is positive under the solution to (P), there exists a unique $\langle D, \alpha, p, e\rangle$ such that $\alpha V'(e) = C'(e)$, $p = V(e) - D$, $\alpha D = \alpha V(e) - C(e)$, and $\alpha \in [1/2, 1]$ satisfying $\alpha \in \{1/2, 1\}$ or the ex ante first-order condition for (P),

$$\frac{1}{\alpha^2}C(e^+(\alpha)) = C'(e^+(\alpha))e^{+\prime}(\alpha). \tag{E.1}$$

The specific functional form allows us to express $\langle D, \alpha, p, e\rangle$ in closed form. The first-order condition for effort $\alpha V'(e) = C'(e)$ yields $e = \left(\frac{\alpha\theta}{c}\right)^{\frac{1}{n-1}}$. The equilibrium stake α solves (E.1). One can show that this condition holds if and only if

$$\theta e^{+\prime}(\alpha)\left(\frac{n-1}{n}-\alpha\right)=0,$$

which in turn holds if and only if $\alpha = 0$ (since $e^{+\prime}(0) = 0$) or $\alpha = \frac{n-1}{n}$. Of these, only $\alpha = \frac{n-1}{n}$ is admissible as a solution to (P). It is straightforward to verify that

$$D=\frac{(n-1)\theta}{n}\left(\frac{(n-1)\theta}{nc}\right)^{\frac{1}{n-1}}$$

and

$$p=\frac{\theta}{n}\left(\frac{(n-1)\theta}{nc}\right)^{\frac{1}{n-1}}.$$

Furthermore, the bidder's profit under the solution to (P) is positive since

$$\begin{aligned} D-C(e^{+}(\alpha)) &= \frac{(n-1)\theta}{n}\left(\frac{(n-1)\theta}{nc}\right)^{\frac{1}{n-1}}-\frac{(n-1)\theta}{n^{2}}\left(\frac{(n-1)\theta}{nc}\right)^{\frac{1}{n-1}} \\ &= \theta\left(\frac{n-1}{n}\right)^{2}\left(\frac{(n-1)\theta}{nc}\right)^{\frac{1}{n-1}} \geqslant 0. \end{aligned}$$

To sum up, there is a unique equilibrium in which

$$\langle D,\alpha,p,e\rangle=\left\langle\frac{(n-1)\theta}{n}\left(\frac{(n-1)\theta}{nc}\right)^{\frac{1}{n-1}},\frac{n-1}{n},\frac{\theta}{n}\left(\frac{(n-1)\theta}{nc}\right)^{\frac{1}{n-1}},\left(\frac{\frac{n-1}{n}\theta}{c}\right)^{\frac{1}{n-1}}\right\rangle.$$

As power functions are log-concave for all $n \in \mathbb{N}$, (more) debt always increases the post-takeover share value and target shareholder wealth (cf. proof of Proposition 2). Equilibrium leverage can be high. The debt-equity ratio is $D/p = n-1$. For $n = 5$, the ratio equals 4. $\lhd$

Example E.2 (Exponential functions.). Let $V(e) \equiv \theta e$ and $C(e) \equiv \exp(e)$ with $\theta > \exp(2)$. These functions satisfy all our assumptions, and can be shown to entail unique solutions to (P) (proof available upon request). If the bidder's profit is positive under (P), there is a unique $\langle D, \alpha, p, e\rangle$ such that $\alpha V'(e) = C'(e)$, $p = V(e) - D$,

$\alpha D = \alpha V(e) - C(e)$, and $\alpha \in [1/2, 1]$ either satisfying the ex ante first-order condition (E.1) or $\alpha \in \{1/2, 1\}$. The post-takeover first-order condition $\alpha V'(e) = C'(e)$ yields $e^+(\alpha) = \ln(\alpha\theta)$, which is stictly positive given $\alpha\theta > \frac{\exp(2)}{2} > 1$. Substituting $e^+(\alpha)$ into the profit function of (P) yields

$$\theta \ln(\alpha\theta) - (1 + 1/\alpha)\alpha\theta.$$

Differentiating with respect to α yields $\theta(1/\alpha - 1)$, which is strictly positive for all $\alpha \in [1/2, 1)$. Thus, $\alpha = 1$ is the unique solution to (P). It is straightforward to verify that

$$D = \theta \ln(\theta) - \theta$$

and

$$p = \theta.$$

Furthermore, the bidder's profit is

$$D - C(e^+(1)) = \theta(\ln(\theta) - 2),$$

which is positive since $\theta > \exp(2)$ implies $\ln(\theta) > 2$. To summarize, there is a unique equilibrium in which

$$\langle D, \alpha, p, e \rangle = \langle \theta \ln(\theta) - \theta, 1, \theta, \ln(\theta) \rangle.$$

As exponential functions are weakly log-concave, leverage is weakly Pareto-improving. With $\alpha = 1$ in equilibrium, first-best incentives are restored. The equilibrium debt-equity ratio is $D/p = \ln(\theta) - 1$. For example, if $\theta = \exp(5)$, the ratio is 4. $\lhd$

References

America for Sale? An Examination of the Practices of Private Funds (2019). Hearings before the House Committee on Financial Services (testimony of Eileen Appelbaum). 116th Congress. Washington: Government Printing Office.

Amihud, Y., M. Kahan, and R. K. Sundaram (2004). The foundations of freezeout laws in takeovers. *The Journal of Finance 59*(3), 1325–1344.

Anderson, R. C., S. A. Mansi, and D. M. Reeb (2003). Founding family ownership and the agency cost of debt. *Journal of Financial Economics 68*, 263–285.

Andrade, G. and S. N. Kaplan (1998). How costly is financial (not economic) distress? evidence from highly leveraged transactions that became distressed. *Journal of Finance 53*, 1443–1494.

Appelbaum, E. and R. Batt (2014). *Private Equity At Work: When Wall Street Manages Main Street.* New York: Russell Sage Foundation.

Appelbaum, E. and R. Batt (2018, October 3, 2018.). Private equity pillage: Grocery stores and workers at risk. *The American Prospect*. https://prospect.org/power/private-equity-pillage-grocery-stores-workers-risk/.

Axelson, U., T. Jenkinson, P. Stromberg, and M. W. Weisbach (2013). Borrow cheap, buy high? the determinants of leverage and pricing in buyouts. *Journal of Finance 68*(6), 45–67.

Axelson, U., P. Stromberg, and M. W. Weisbach (2009). Why are buyouts levered? the financial structure of private equity firms. *Journal of Finance 64*, 1549–1582.

Berle, A. and G. Means (1932). *The Modern Corporation and Private Property.* Harcourt, Brace & World New York.

Boucly, Q., D. Sraer, and D. Thesmar (2011). Growth LBOs. *Journal of Financial Economics 102*(2), 432–53.

Burkart, M., D. Gromb, H. M. Müller, and F. Panunzi (2014). Legal investor protection and takeovers. *The Journal of Finance 69*(3), 1129–1165.

Burkart, M., D. Gromb, and F. Panunzi (1998). Why higher takeover premia protect minority shareholders. *Journal of Political Economy 106*(1), 172–204.

Burkart, M. and S. Lee (2015). Signalling to dispersed shareholders and corporate control. *The Review of Economic Studies 82*(3), 922–962.

Chowdhry, B. and V. Nanda (1993). The strategic role of debt in takeover contests. *Journal of Finance 48*(2), 731–45.

Chung, J.-W. (2011). *Leveraged Buyouts of Private Companies.* Working paper.

Cohn, J. B., E. S. Hotchkiss, and E. Towery (2020). *The Motives for Private Equity Buyouts of Private Firms: Evidence from U.S. Corporate Tax Returns.* Working paper.

Dalkir, E., M. Dalkir, and D. Levit (2019). Freeze-out mergers. *Review of Financial Studies 32*(8), 3266–3297.

DeMarzo, P. M., I. Kremer, and A. Skrzypacz (2005). Bidding with securities: Auctions and security design. *American Economic Review 95*(4), 936–59.

Grossman, S. J. and O. D. Hart (1980). Takeover bids, the free-rider problem, and the theory of the corporation. *The Bell Journal of Economics 11*(1), 42–64.

Hansen, R. G. (1985). Auctions with contingent payments. *American Economic Review 75*(4), 862–65.

Holmstrom, B. and S. N. Kaplan (2001). Corporate governance and merger activity in the united states: Making sense of the 1980s and 1990s. *Journal of Economic Perspectives 15*(12), 121–144.

Holmström, B. and B. Nalebuff (1992). To the raider goes the surplus? a reexamination of the free-rider problem. *Journal of Economics & Management Strategy 1*(1), 37–62.

Innes, R. D. (1990). Limited liability and incentive contracting with ex-ante action choices. *Journal of Economic Theory 52*(1), 45–67.

Jarrell, G. A., J. A. Brickely, and J. M. Netter (1988). The market for corporate control: The empirical evidence since 1980. *Journal of Economic Perspectives 2*(1), 49–68.

Jensen, M. C. (1986). Agency costs of free cash flow, corporate finance, and takeovers. *American Economic Review 76*(2), 323–329.

Jensen, M. C. (1988). Takeovers: Their causes and consequences. *Journal of Economic Perspectives 2*(1), 21–84.

Jensen, M. C. and W. H. Meckling (1976). Theory of the firm: Managerial behavior, agency costs and ownership structure. *Journal of Financial Economics 3*(4), 305–360.

Kaplan, S. N. (1989). The effects of management buyouts on operations and value. *Journal of Financial Economics 24*, 217–54.

Kaplan, S. N. and J. Stein (1993). The evolution of buyout pricing and financial structure in the 1980s. *Quarterly Journal of Economics 108*(2), 313–58.

Kaplan, S. N. and P. Stromberg (2009). Leveraged buyouts and private equity. *Journal of Economic Perspectives 23*(1), 121–46.

Kosman, J. (2009). *The Buyout of America.* New York: Penguin Group.

Kosman, J. (2012). Why private equity firms like bain really are the worst of capitalism. *Rolling Stone Magazine May 23.*

Lagaras, S. and M. Tsoutsoura (2015). *Family Control and the Cost of Debt: Evidence from the Great Recession.* Working paper, Cornell University.

Leveraged Buyouts and Corporate Debt (1989). Hearings before the Senate Committee on Finance (testimony of Alan Greenspan). 100th Congress. Washington: Government Printing Office.

Malenko, A. and N. Malenko (2015). A theory of lbo activity based on repeated debt-equity conflicts. *Journal of Financial Economics 117*(3), 607–27.

Manne, H. G. (1965). Mergers and the market for corporate control. *Journal of Political Economy 73*(2), 110–120.

Müller, H. M. and F. Panunzi (2003). Tender offers and leverage. *Working Paper Series, Credit and Debt Markets Research Group*.

Müller, H. M. and F. Panunzi (2004). Tender offers and leverage. *Quarterly Journal of Economics 119*(4), 1217–1248.

Myers, S. C. (1977). Determinants of corporate borrowing. *Journal of Financial Economics 5*(2), 147–175.

Rhodes-Kropf, M. and S. Viswanathan (2000). Auctions with contingent payments. *Journal of Finance 55*(4), 1807–49.

Rudin, W. (1964). *Principles of mathematical analysis*, Volume 3. McGraw-Hill New York.

Scigliuzzo, D., K. Butler, and S. Bakewell (2019). Everything is private equity now. *Bloomberg Businessweek*, October 3, 2019. https://www.bloomberg.com/news/features/2019-10-03/how-private-equity-works-and-took-over-everything.

Shleifer, A. and L. H. Summers (1988). Breach of trust in hostile takeovers. In A. J. Auerbach (Ed.), *Corporate Takeovers: Causes and Consequences*, pp. 33–56. Chicago: University of Chicago Press.

Shleifer, A. and R. S. Vishny (1990). The takeover wave of the 1980s. *Science 249*(4970), 745–749.

Shleifer, A. and R. W. Vishny (1986). Large shareholders and corporate control. *Journal of Political Economy 94*(3, Part 1), 461–488.

Yarrow, G. K. (1985). Shareholder protection, compulsory acquisition and the efficiency of the takeover process. *The Journal of Industrial Economics 34*(1), 3–16.