

Private Equity Acquisitions and Strategic Buyers: Information Discounts versus Synergies*

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Abstract We characterize when private equity funds have a competitive advantage over strategic buyers in acquiring a target firm. Private equity funds are more inclined to cut loss-making projects, thereby gaining an information advantage for understanding value creation with the target's remaining assets. Strategic buyers more often integrate with the target to obtain synergy gains. Private equity funds are more likely to win takeover competitions when their information advantage is greater, their required return premium is smaller, and strategic buyers' synergy gains are smaller. Such takeovers by private equity funds can improve economic welfare.

Keywords: Private Equity, Takeover Competition, Information Frictions, Welfare

JEL subject codes: G24, G32, G34

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1 Introduction

The amount of capital allocated to private equity funds is substantial and the resulting activities by such funds are impressive (e.g., Strömberg, 2008; Sørensen et al., 2013; Norbäck et al., 2013). For example, U.S. private equity funds raised about \$175 billion and European funds raised about €97 billion in 2018.¹ The persistent and substantial amount of capital allocated to private equity funds indicates that such funds are perceived to generate value to investors. Still, the economic value to society is debated among academics as well as in the media.² While there is an increasing amount of empirical literature analyzing the role of private equity funds, the theoretical literature on the subject remains thin, although theory is needed to address the question of social value.

The present paper provides a theoretical framework useful for analyzing the role played by private equity funds and how that role creates value. Our model considers a setup in which private equity funds compete with strategic buyers. We use their differences in both skills and objective functions to derive a realistic characterization of the key elements determining whether a private equity fund is successful in its acquisition effort. Competition with the strategic buyer raises the bar for the funds, and also gives the funds a role in preventing anti-competitive conduct by the strategic buyer. The theory allows us to address how private equity acquisitions may generate value to society and not only to investors.

Some stylized facts on private equity funds must be incorporated in our model. First, they typically undertake major changes to their acquired firms, delisting them from the stock exchange while assets are restructured. Second, funds have restrictive requirements for generating high returns to the partners. Third, their investments must pay off on a shorter horizon, typically within six years (e.g., Kaplan and Strömberg, 2009). We take these features for granted, as exogenously given arrangements among limited and general partners.

Our core idea to explain a private equity fund's role is that the wider financial market's

¹Statistics from the American Investment Council 2019 Q1 Private Equity Trends Report and the European Venture Capital Association European Private Equity Activity Report 2018, respectively. Available at <http://www.investmentcouncil.org/> and <http://evca.eu/>, respectively. Accessed July 2019.

²See, e.g., "Amid Attacks on Private Equity, Efforts to Study Its Value", *The New York Times* (January 24, 2012), "Private equity adds value to investors as well as businesses", *Financial Times* (June 14, 2013), and "Private Equity – Adding Value?", *The Economist* (February 8, 2013).

valuation of the target firm is distorted due to frictions. In general, private benefits can distort investment decisions. Specifically, we will assume that the firm inefficiently keeps some legacy assets which convey benefits to most types of owners and managers, but not to the profit-oriented private equity owners. Legacy assets complicate the owner's ability to understand the firm, and they reduce the incentive to acquire information about potential new investments.³ Such information frictions prevent the firm from following a value improving investment policy. Our model relies on the special skill and special motivation that private equity funds have to mitigate information frictions of this kind.⁴ These skills create value to investors and society as soon as the growth option pays off in the restructured target firm. In successful outcomes, the private equity fund can sell again within its limited time horizon.

We pay attention to the fact that private equity funds, target firms, and other operating firms (strategic buyers) considering a takeover are pitted in a contest against each other, and therefore need to outbid each other. This provides an analysis of bidding incentives that is richer than in frictionless financial markets, but our focus is precisely on the role of private equity funds in markets with frictions. Strategic buyers desire to take over the target company in order to obtain a competitive advantage over other operating firms. However, like the target firm, a strategic buyer can be subject to an information friction which limits its ability to bid for the target.

A somewhat similar game between private equity funds and strategic buyers is considered in a few recent papers, e.g., Hege et al. (2013) and Martos-Vila et al. (2019). The latter rests on the assumption that the financial market evaluates debt incorrectly because uninformed investors have a wrong perception of the success probabilities. Their paper is related to ours in the sense that valuation and decision making is distorted by a lack of information. However, in contrast to the more behavioral approach in Martos-Vila et al. (2019), we assume that a private equity fund's information advantage is due to its skills to obtain information and to its credible commitment to a loss-cutting strategy. Indeed, we emphasize the private equity fund's willingness to repackage assets in acquired target firms, sometimes unsettling for the work force involved. This may reconcile the view that

³Frictions stemming from private benefits and information asymmetries also inefficiently restricts the firm's access to outside financing.

⁴As we explain later, there is a need for some investors to acquire reliable information, and reliability is highest when the investor conducts his own investigation.

funds sell loss-making parts of firms with the evidence that average portfolio firms exhibit growth in economic activity and employment.

Our main framework involves three players:⁵ the manager (target), a strategic buyer, and a private equity fund. Therefore, we need to be very specific about these players and to make assumptions which yield a parsimonious and tractable, yet insightful, model. The outside investors have no special information. Their only role is to provide a reservation value for the target firm when considering bids from the strategic buyer and the private equity fund. If the strategic buyer or private equity fund will pay more than this reservation value for the target firm, the firm is sold to the party with the highest value.

The strategic buyer's incentive to take over the manager's firm depends on the synergy gains which can be created by combining the strategic buyer and the target. Instead, the private equity fund exploits information frictions in financial markets by buying firms and subsequently restructuring the acquired firms in order to eliminate these frictions.⁶ Parallel to this, the private equity fund also aims to realize any embedded growth option such that the restructured firms can be sold back (i.e., evaluated without an informational friction discount) to the financial market with a higher return.

Our analysis shows under which conditions private equity funds have a competitive advantage in acquiring target firms with a potential. The private equity fund wins the takeover competition if its information advantage is sufficiently important. The private equity fund cannot win the target unless it is able to employ its assets for a gain that is at least comparable to the synergy gain obtained by the strategic buyer. It handicaps the private equity fund that it is constrained to deals that offer a return premium over the market rate, but it is to the fund's advantage that it is less financially constrained once it owns the target. Private benefits explain why the target manager and the strategic buyer keep the legacy asset and accept an information cost, but they also directly contribute to the strategic buyer's valuation for the target, so they do not necessarily pave the way for a private equity takeover.

Since the activities of private equity funds are highly debated, we also consider welfare effects for the broader economy. Most forces that enable the private equity fund to win the takeover in our model also improve the efficiency of investment, thereby improving society's

⁵In an extension, we also include outside investors.

⁶As part of this, we analyze a private equity fund's incentives to acquire several firms and restructuring them into one merged firm either sequentially or simultaneously.

welfare. It is then more likely that the absence of a private equity takeover indicates a loss, as the other owners maintain private benefits and possess inferior information. The exact welfare assessment of the takeover depends on the relative economic benefit of the gains obtained by the different owner types using the target's assets. A part of the strategic buyer's synergy gain naturally stems from anti-competitive conduct, reducing efficiency. However, part of the private equity fund's gain may come from tax avoidance which may harm the broader economy.

The remainder of the paper is organized as follows. Section 2 sets up the model and we solve it in Section 3. Section 4 analyses welfare implications and discussion, and we consider various extensions in Section 5. Finally, we conclude in Section 6. Proofs are postponed to the appendix.

2 Model and Valuations

We model the potential sale of a target firm to a private equity (PE) fund. This section introduces our model involving the firm's original owner, competitive strategic buyers, and the PE fund. For now, we assume that all three player types have sufficient funds, allowing us to ignore any differences arising when the three player types interact with outside investors. To simplify the exposition, we set the risk-free interest rate to zero, and suppose that all parties are risk neutral.

2.1 Possible Transactions

The owner-manager (henceforth, manager) of the target firm has three opportunities. Opportunity 1 is to make no transaction, keeping the firm as it is. Opportunity 2 is selling the firm to a strategic buyer. Opportunity 3 is selling the firm to the PE fund.

We will assume that the final transaction is an efficient allocation from the point of view of the investors. The precise values of the three opportunities depend on some frictions specified below. The relative strengths of these frictions determine the allocation. The frictions also have implications for the welfare efficiency of this outcome.

We assume the manager has all the bargaining power vis-a-vis competitive strategic buyers, and that a strategic buyer pays in cash to take over the entire target firm.⁷ The

⁷This assumption is relaxed in an extension. Full strength of the manager isolates the hardest case for the PE fund to be able to beat its competition for a takeover of the target.

manager then relies on the most efficient of opportunities 1 and 2 to define the reservation value of the firm in negotiations with the PE fund. When the PE fund creates most value for investors and thus takes over the firm, the resulting terms of the transaction are determined by bilateral bargaining between the fund and the manager. We assume that also the PE fund pays in cash.⁸

2.2 Information and Investment in the Target Firm

The target firm has productive assets in place which can be viewed as the union of A_1 and A_2 . The target firm has no liquid funds. Asset A_1 provides the target's valuable opportunities through a two-stage growth option, while A_2 is a bad legacy asset. Both assets offer private benefits which is a source of frictions. The size of private benefits depends on who is in control of the firm and on which investments are made, and we will specify these private benefits in the subsections below.

If no investment is made, A_1 returns zero cash-flow (beyond private benefits). More importantly, investment can unlock value from A_1 . An initial investment of amount $I_1 > 0$ in asset A_1 will generate an observable signal s . The signal is informative about the random state $\theta \in \{0, 1\}$ which will indicate whether investment results in success. Upon observation of this signal's outcome, it is possible to follow up with a second investment of size $I_2 > 0$. If the second investment is not made, the asset returns zero cash flow. If both rounds of investment are carried out, asset A_1 returns cash θV_{A_1} , thus depending on the random state θ . All players in the model share a prior belief $p = \Pr(\theta = 1)$, where $0 < p < 1$. The success value $V_{A_1} > 0$ is an exogenous parameter. Figure 1 illustrates the timing of the model.

The bad asset A_2 always returns zero cash-flow (beyond private benefits). The most important friction stemming from A_2 is that it complicates inference regarding A_1 . Initial divestment of A_2 will improve transparency in the firm, and simplify information generation regarding the potential in A_1 . If the owners first divest A_2 , the signal is clear — for simplicity, $s = \theta$ in this case. If instead A_2 is kept, we let $s \in \{0, 1\}$ satisfy $\Pr(s = 1|\theta = 1) = 1/\eta$ and $\Pr(s = 1|\theta = 0) = 0$. Here $\eta \geq 1$ may depend on who owns the asset.⁹ The

⁸Alternative contracts will be discussed in an extension.

⁹We could choose other specifications of the signal structure, but this model already captures our main idea. We could also assume that the three player types have different costs (I_1) of acquiring information, but this would not add to the story.

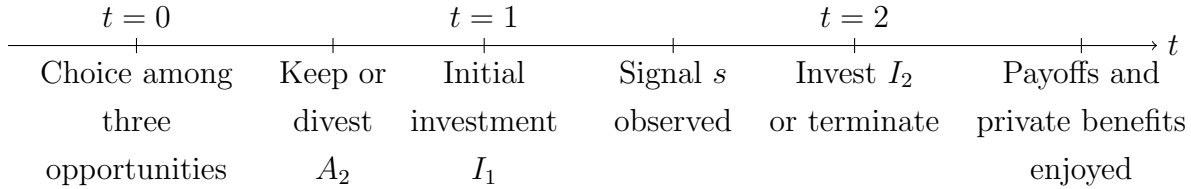


Figure 1: **Timeline of the model.**

greater is η , the greater is the information friction induced by legacy asset A_2 . We can think of divestment of A_2 as implying the special case $\eta = 1$.

Upon observation of s , Bayes' rule provides posterior $\Pr(\theta = 1|s = 1) = 1$ and $\Pr(\theta = 1|s = 0) = (p\eta - p)/(\eta - p)$. The posterior belief after $s = 0$ is lower than after $s = 1$, but less so when η is greater. Note that $\Pr(s = 1) = p/\eta$. The greater is η , the lower the chance that $s = 1$ is observed.

Being closer to the specific line of business of the target firm, it can be natural to assume that the manager and the strategic buyer have a lower η than a PE fund — they find it easier to acquire information about the business. However, as will become clear, private benefits will ultimately imply that the manager and the strategic buyer keep A_2 , while the PE fund divests it. This will de facto give the PE fund an information advantage, because it will reduce its effective η to 1.

For any specification of the signal, Bayes' rule allows computation of the posterior belief π . This is a random variable that satisfies $\mathbb{E}[\pi] = \Pr(\theta = 1)$. A better informed decision maker obtains a distribution of π that is more variable in the sense of a mean-preserving spread, or equivalently in the sense of second-order stochastic dominance, or the convex order: for any convex function h , $\mathbb{E}[h(\pi)]$ is greater. See Rothschild and Stiglitz (1970). The PE fund's informational advantage, a lower η , benefits the fund's valuation through this effect.

It remains to fully specify the private benefits, which depend on the owner type. In the following, we complete this specification for each owner type. For each given owner type, we will also derive the valuation of the firm given optimal decisions after time 0. However, our assumptions imply that the strategic buyer generates more value than the manager for any fixed course of action, and hence we will skip precise valuation for the manager.

2.3 Manager in Control

Suppose the firm is not sold, but stands alone. We will proceed here under the assumption that the manager has sufficient capital available to make both investments.¹⁰ If both investments are made, asset A_1 provides the manager a private benefit of $U_{A_1} \geq 0$, independent of the realization of success variable θ . Otherwise, the private benefit from A_1 is reduced to zero. If kept, A_2 provides the manager private benefit $U_{A_2} \geq 0$. Let $\eta_m > 1$ denote the manager's information friction if A_2 is kept.

Suppose, at time 2, the manager's posterior belief is π . Focusing on the contribution from asset A_1 , this stage's expected net payoff from undertaking investment I_2 is then $U_{A_1} + \pi V_{A_1} - I_2$. The alternative provides net payoff zero. The optimal subgame payoff as a function of belief π is thus

$$\max\{0, U_{A_1} + \pi V_{A_1} - I_2\}. \quad (1)$$

2.4 Strategic Buyer's Valuation

A strategic buyer aims to integrate with the target firm. The strategic buyer operates in the same business as the target firm, and hence shares the manager's ability to extract private benefits from A_1 , worth U_{A_1} if both investments are made. If A_2 is kept, likewise a strategic buyer obtains the private benefit U_{A_2} , and the information friction parameter becomes $\eta_{sb} > 1$. We assume that the information friction for the strategic buyer is no greater than that for the manager.

Assumption 1 *Information frictions satisfy $\eta_m \geq \eta_{sb} > 1$.*

This assumption ultimately implies that the strategic buyer, providing also the synergy gain and additional private benefits, can always generate more value than the manager.

Acquisition of the target also unleashes synergy gains in two forms that matter for the welfare analysis in Section 4. A welfare-enhancing synergy gain comes in the form of cash value $G_{SB} > 0$ if both investments are made, and the good state $\theta = 1$ is realized. This gain arises from more efficient use of the firms' pooled resources. In addition, the strategic buyer obtains private synergy gain $U_Q \geq 0$ if both investments are made — like U_{A_1} , we suppose this gain is independent of the realization of success variable θ . Such

¹⁰We later extend the model to consider frictions when the manager needs to raise such capital.

private synergy gains can arise, for example, through increased market power. They may also arise from private benefits from control.¹¹

Suppose, at time 2, the strategic buyer's posterior belief is π . The expected net payoff, at this stage, from undertaking investment I_2 is then $U_{A_1} + U_Q + \pi(V_{A_1} + G_{SB}) - I_2$. The optimal subgame payoff as a function of belief π is then

$$\max\{0, U_{A_1} + U_Q + \pi(V_{A_1} + G_{SB}) - I_2\}. \quad (2)$$

Observe that, at any given posterior belief π , the strategic buyer expects higher payoff than the manager at this stage. The payoff expression in (2) is no smaller than (1), and they are equal only if (2) is zero. Since the strategic buyer provides additional private benefits, and also has better information by Assumption 1, the strategic buyer's valuation of the target firm dominates the stand-alone option.

While not crucial for the analysis, we find it natural to assume that the optimal investment decision at time 2 depends in a non-trivial way on information. More precisely, the zero payoff prevails in (2) when $\pi = 0$, but not when $\pi = 1$.

Assumption 2 *Ex post, the strategic buyer gains from investing I_2 if and only if $\theta = 1$: $U_{A_1} + U_Q + V_{A_1} + G_{SB} > I_2 > U_{A_1} + U_Q$.*

Thus, private benefits alone are not a sufficient reason for the strategic buyer to undertake the second stage investment.

At time 1, the strategic buyer decides whether to make the initial investment. If the initial investment is not made, the project is terminated, for overall payoff U_{A_2} or 0, depending on whether A_2 was previously kept or divested.

As described above, the initial investment generates signal s , and thus defines the distribution over the random posterior belief π . When A_2 is divested, so the information friction is eliminated, the strategic buyer's expected net gain from undertaking this investment is W_1 , defined by

$$W_1 = p(U_{A_1} + U_Q + V_{A_1} + G_{SB} - I_2) - I_1. \quad (3)$$

When A_2 is kept, the information friction is $\eta_{sb} > 1$, and assumption 2 does not suffice to predict the optimal choice at signal $s = 0$. Recall that the strategic buyer's probability of

¹¹See e.g. Barclay and Holderness (1989); Doidge et al. (2009); Wang and Wu (2018). Furthermore, the strategic buyer depends less on outside investors, and hence is under less outside pressure to reduce private benefits.

obtaining signal $s = 1$ is p/η_{sb} . The strategic buyer's expected net gain from undertaking the investment is thus W_2 , defined by

$$W_2 = \frac{p}{\eta_{sb}} (U_{A_1} + U_Q + V_{A_1} + G_{SB} - I_2) + \frac{\eta_{sb} - p}{\eta_{sb}} \max\{0, U_{A_1} + U_Q + \frac{p\eta_{sb} - p}{\eta_{sb} - p} (V_{A_1} + G_{SB}) - I_2\} - I_1, \quad (4)$$

where we recall that $(p\eta_{sb} - p)/(\eta_{sb} - p)$ is the probability the random state is good conditional on $s = 0$. It is a relatively simple exercise to verify that $W_1 > W_2$ when $\eta_{sb} > 1$. More generally, (4) is a non-increasing function of η_{sb} . That is, the greater the strategic buyer's information friction is, the lower is its expected net gain from investing.

Lemma 1 *If $\eta_{sb} > 1$ then $W_1 > W_2$, and (4) is non-increasing in η_{sb} .*

Before time 1, the strategic buyer chooses whether to keep A_2 . The utility from keeping it is $U_{A_2} + \max\{0, W_2\}$, and we impose the assumption that the strategic buyer prefers to keep A_2 . Since $U_{A_2} > 0$, this can be written as follows:

Assumption 3 *A strategic buyer prefers to keep A_2 : $\max\{U_{A_2}, U_{A_2} + W_2\} > W_1$.*

The strategic buyer's expected gain from the takeover is thus

$$U_{A_2} + \max\{0, W_2\}. \quad (5)$$

Lemma 2 *The strategic buyer's willingness to pay (5) is increasing in G_{SB} without bound, decreasing in η_{sb} , and increasing in private benefits.*

We have assumed that the manager has all the bargaining power against the strategic buyer. Therefore, (5) is the most the strategic buyer is willing to offer, also denoted the maximum willingness to pay. This offer is attractive to the manager by assumption.

2.5 Private Equity Fund's Valuation

Due to the internal contractual structure and the methods employed by the PE fund, we assume that it annihilates private benefits. It is a stylized feature that this investor type does not enjoy private benefits in the same way as other owner types do.¹² Without private benefits from A_2 , in particular, the exact value of $\eta_{pe} > 1$ for the PE fund will be irrelevant to the analysis.

¹²For indirect empirical evidence, see e.g., Gorbenko and Malenko (2014).

The PE fund has the potential to create a welfare-enhancing synergy gain $G_{PE} \geq 0$. This synergy gain is unleashed only if investment in the target's A_1 results in a successful outcome, $\theta = 1$. The synergy gain most naturally stems from merging the target firm with another firm of independent value in the PE fund's portfolio. This other firm would create additional value, which we assume independent of investment or success in A_1 . Alternatively, G_{PE} could derive from operational improvements that the PE fund is capable of undertaking.¹³

The PE fund has promised its partners a higher risk-neutral return $r \geq 0$ on capital. The higher return is effectively a rent accruing to the PE fund from its ability to create value in target firms. This ability is not priced in the market except through this very channel that higher returns can be earned on projects where the PE fund provides financing.¹⁴

Suppose, at time 2, the PE's posterior belief is π . The expected net payoff, at this stage, from undertaking investment I_2 is then $\frac{\pi}{1+r}(V_{A_1} + G_{PE}) - I_2$. The optimal subgame payoff as a function of belief π is

$$\max\{0, \frac{\pi}{1+r}(V_{A_1} + G_{PE}) - I_2\}. \quad (6)$$

Comparing (2) with (6), observe that the strategic buyer has an ex post advantage over the PE fund if $G_{PE} < U_{A_1} + U_Q + G_{SB}$. In this case, for any given posterior belief π and any $r \geq 0$, then (2) exceeds (6), identical only when (2) is zero.

In analogy with Assumption 2, we assume that the PE fund's final investment decision depends on the belief π .

Assumption 4 *Ex post, the PE fund gains from investment 2 if and only if $\theta = 1$: $V_{A_1} + G_{PE} > (1+r)I_2 > 0$.*

The PE fund obtains no private benefit from A_2 , so keeping it is weakly dominated. On the other hand, we assume the PE fund actually gains from the better signal obtained from divesting A_2 .

¹³For evidence on both of these possibilities, see e.g., Hammer et al. (2017) and Malenko and Malenko (2015). An extension in Section 5 addresses the issue of acquiring the initial firm in the PE fund's portfolio.

¹⁴This required return represents a friction in our model. It naturally stems from the agency problem between the general and limited partners of the fund, which puts a constraint on the available capital, see Axelson et al. (2009).

Assumption 5 *The PE fund invests at $t = 1$ if A_2 is divested:*
 $p(V_{A_1} + G_{PE} - (1+r)I_2) > (1+r)^2 I_1$.

The PE fund is willing to offer its net gain,

$$\frac{p}{1+r} \left(\frac{1}{1+r} (G_{PE} + V_{A_1}) - I_2 \right) - I_1. \quad (7)$$

Lemma 3 *The PE fund's maximal offer (7) decreases in r , and increases without bound in G_{PE} .*

3 Analysis of the Outcome

We will analyze the manager's choice between the PE fund and the two outside opportunities, i.e., which ownership is efficient from the viewpoint of investors.

Intuitively, the PE fund creates less value by killing the private benefits that can be enjoyed by other owners. Depending on the size of synergy gain G_{PE} , this may even imply that for any posterior belief π of the owner, the PE fund can expect lower value from any given investment strategy in the firm. It adds to this disadvantage that the PE fund requires a higher return on investments, r .

However, the private benefits are such that the strategic buyer prefers to keep the legacy asset A_2 , cf. Assumption 3. This implies that the PE fund obtains a more precise signal before choosing to invest I_2 . Therefore, the distribution of the PE fund's posterior belief is more variable than that of the strategic buyer. Assumption 4 implies that the PE fund lets the second investment decision depend on the signal's realization. This optionality creates a convexity in the PE fund's expected payoffs as a function of posterior belief π .

We illustrate the full situation in Figure 2. Once the PE fund's information advantage is sufficiently great, its expected value at stage 0 can exceed that of the other owner types. The PE fund better exploits the convexity in the payoff function and can, therefore, have a higher expected value even if it has a dominated payoff function for any given posterior.

We now derive the parameter condition for the manager to prefer a takeover by the PE fund. Since bargaining is efficient among the investors, such a takeover occurs whenever the fund is willing to pay more than the strategic buyer. Comparing (7) to (5), we can find the owner predicted by our analysis. In particular, the PE fund will take over if the synergy G_{PE} created by the PE fund is sufficiently large.

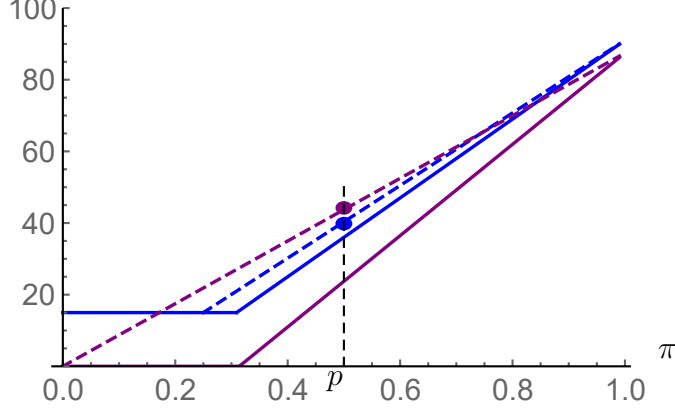


Figure 2: **Value of Information.** Purple lines illustrate the subgame payoff (6) to a PE fund as a function of the belief π about the investment's viability θ . The purple circle shows the expected payoff to a fully informed fund at prior belief $p = 0.5$ (black dashed line). Blue lines likewise illustrate the payoff (2) plus U_{A_2} to a strategic buyer who keeps A_2 , with the blue circle indicating the expected payoff. Benchmark parameters from Section 3.4 are used.

Proposition 1 *A takeover by the PE fund occurs if the return premium r is not too big, the synergy gain G_{PE} from a PE-takeover is sufficiently larger than the alternative synergy gain G_{SB} , the private benefits U_{A_1}, U_{A_2}, U_Q are not too large, and the information friction η_{sb} is large enough.*

The PE-takeover condition, that (7) exceeds (5), can be typed out as

$$\begin{aligned} & \frac{p}{1+r} \left(\frac{1}{1+r} (G_{PE} + V_{A_1}) - I_2 \right) - I_1 \\ & \geq U_{A_2} + \max \left\{ 0, \frac{p}{\eta_{sb}} (U_{A_1} + U_Q + V_{A_1} + G_{SB} - I_2) \right. \\ & \quad \left. + \frac{\eta_{sb} - p}{\eta_{sb}} \max \{ 0, U_{A_1} + U_Q + \frac{p\eta_{sb} - p}{\eta_{sb} - p} (V_{A_1} + G_{SB}) - I_2 \} - I_1 \right\}. \end{aligned} \quad (8)$$

As noted before, the strategic buyer has an ex post advantage over the PE fund if $G_{PE} < U_{A_1} + U_Q + G_{SB}$, particularly if $G_{PE} < G_{SB}$. We can now see that this translates into an ex ante advantage. From (3), $W_1 + I_1$ strictly exceeds the fund's left-hand-side of (8) under this parameter condition. But Assumption 3 implies that the strategic buyer's right-hand-side of (9) is at least $W_1 + I_1$.

Going forward, it is convenient to analyze this general condition in the three possible cases for the strategic buyer's investment policy which are possible under our assumptions.

3.1 Strategic Buyer Invests like the PE Fund

Assume that the strategic buyer prefers to behave like the PE fund: investing at time 1, and terminating the project at time 2 if $s = 0$. Then the parameter condition for a PE takeover becomes

$$\frac{p}{1+r} \left(\frac{1}{1+r} (G_{PE} + V_{A_1}) - I_2 \right) \geq U_{A_2} + \frac{p}{\eta_{sb}} (U_{A_1} + U_Q + G_{SB}) + \frac{p}{\eta_{sb}} (V_{A_1} - I_2). \quad (9)$$

This is simply a comparison of the present values of A_1 for the PE fund and strategic buyer, with the addition of private benefit U_{A_2} to the strategic buyer's valuation.

Interpreting (9), recall that the terms G_{PE} and G_{SB} capture the synergy gains from a takeover. On the right-hand-side, there also appear private benefits that are annihilated by the PE fund. The term $V_{A_1} - I_2$ on both sides is the second-period gain from undertaking the project: with the better information technology, the PE fund obtains this gain with a greater likelihood.

3.2 Strategic Buyer Always Invests

Alternatively, suppose that the strategic buyer does not behave like the PE fund. Instead it invests if it gets a low signal and investment yields a positive net payoff at stage two. By Assumption 2 this cannot occur if η_{sb} is sufficiently small. On the other hand, if η_{sb} is large and p is not too small, it can be understood from Figure 2 that both posteriors of the strategic buyer (after signals 0 and 1) are so close to p that investing I_2 is best. The PE-takeover condition (8) becomes

$$\frac{p}{1+r} \left(\frac{1}{1+r} (G_{PE} + V_{A_1}) - I_2 \right) \geq U_{A_2} + (U_{A_1} + U_Q + pG_{SB}) + (pV_{A_1} - I_2). \quad (10)$$

Intuitively, compared to (9), the strategic buyer no longer takes advantage of the convexity in payoffs in Figure 2, so the dashed blue line is drawn down to the solid blue line. This eases the condition for the PE fund to offer the highest bid. Still, if $G_{PE} < G_{SB}$, the PE fund cannot win the takeover contest.

3.3 Strategic Buyer Never Invests

Finally, suppose that I_1 or I_2 are relatively large, such that the strategic buyer would not invest at time 1 regardless of optimal continuation behaviour at time 2. The PE-takeover

condition (8) then becomes

$$\frac{p}{1+r} \left(\frac{1}{1+r} (G_{PE} + V_{A_1}) - I_2 \right) - I_1 \geq U_{A_2}. \quad (11)$$

The strategic buyer is not acquiring information and hence cannot use convexity. This again eases the condition for the PE fund to take over. In this instance, G_{SB} plays no direct role.

3.4 Comparison

Our analysis is useful for showing under which conditions PE funds have a competitive advantage over strategic buyers in acquiring constrained firms with a potential. The conditions can be seen from Proposition 1 and, in particular, conditions (9), (10), or (11). We consider the trade-offs between the key elements further in the numerical analysis to follow.

For this analysis we use a base case with an ex ante success probability $p = 0.5$, where a successful investment returns $V_{A_1} = 100$. The initial investment cost is $I_1 = 20$ and the second stage investment cost is $I_2 = 40$. Hence, the project yields a net present value of 10, if there are no frictions.¹⁵ The informational frictions induced by keeping the legacy asset A_2 are captured by $\eta_m = 3.5$ and $\eta_{sb} = 1.5$. This implies that the strategic buyer's probability of a high signal is $p/\eta_{sb} = 1/3$, while a low signal gives posterior $\Pr(\theta = 1|s = 0) = (p\eta_{sb} - p)/(\eta_{sb} - p) = 1/4$. For the PE fund the latter posterior is 0. We assume that the private benefits are primarily present in the legacy assets and also present, but to a smaller extent, when the strategic buyer combines assets. Specifically, $U_{A_1} = 0, U_{A_2} = 15$, and $U_Q = 6$.¹⁶ Furthermore, the direct gain of a takeover by the strategic buyer is $G_{SB} = 10$.¹⁷ Similarly, we let the direct gain of a takeover by the PE fund be $G_{PE} = 30$. Clearly, the strategic buyer's direct gain is less than that of the PE fund which, as argued earlier, is necessary for the PE fund to win the takeover contest. On the other hand, there is no higher gain in terms of return realization for the PE fund compared to the strategic buyer; i.e., $G_{PE} = 30 < 31 = U_{A_1} + U_{A_2} + U_Q + G_{SB}$. Finally, the

¹⁵We ensure that Assumptions 2-5 are satisfied in the parameterizations we consider.

¹⁶For this part of the analysis, U_{A_1} and U_Q play a similar role through the sum $U_{A_1} + U_Q$, so we normalize U_{A_1} to zero. In the extension with outside investors, U_{A_1} plays a role independent of U_Q .

¹⁷The base case parameters are such that the strategic buyer invests like the PE fund, so (9) is the relevant condition for a PE takeover. For some of the variations to come, the strategic buyer follows another strategy. This shows up as kinks in the figures.

Table 1: Base case parametrization

Target firm		Strategic buyer		Private equity fund	
$\Pr(\theta = 1)$	0.5	U_{A_1}	0		
V_{A_1}	100	U_{A_2}	15		
I_1	20	U_Q	6		
I_2	40	G_{SB}	10	G_{PE}	30
η_m	3.5	η_{sb}	1.5	r	0.02

PE fund's return requirement is $r = 0.02$. The base case parametrization is summarized in Table 1.

The base case is used to illustrate the subgame payoffs (2) and (6) to the strategic buyer and the PE fund in Figure 2 as functions of the posterior belief. For any given posterior belief, the strategic buyer's payoff dominates that of the PE fund. However, the two competitors do not obtain equally informative signals implying that at the time of the takeover, the strategic buyer in (5) evaluates the takeover to be worth about 20.3, whereas the PE fund in (7) evaluates the takeover to be worth about 22.9. As a consequence the PE fund's bid will be dominating and the PE fund takes over.

Figures 3 and 4 illustrate how the PE fund's valuation advantage depends on some key parameters. By definition, this valuation advantage is the amount by which the left-hand side of (8) exceeds its right-hand side.

The trade-off between the strategic buyer's information friction η_{sb} and the PE fund's required return premium r is illustrated in Figure 3 panel (a). If the information friction is sufficiently low, the features of a PE fund are not valuable enough to compensate for the higher return requirement. As the purple line illustrates, when the return premium is higher, the slack for the information friction is smaller. This makes good sense. Lower information friction makes an acquisition by the strategic buyer more attractive, while a higher return premium puts pressure on the PE fund's maximum willingness to pay. As a result, a private equity takeover is less likely.

Similarly, a takeover by the PE fund is less likely to occur when the private benefits from a strategic buyer's takeover, U_Q , increases because the strategic buyer is willing to pay a higher price for the manager's firm. As seen in panel (b), a higher return requirement to the PE fund amplifies this effect. When U_Q gets high enough a second effect enters and makes the takeover even more valuable for the strategic buyer. The reason is that the

strategic buyer finds it optimal to invest albeit a low signal is obtained, see (4). Given the other base case parameters this happens when $U_Q = 12.5$, and (10) is then the relevant condition for a takeover by the PE fund. This explains the kink in panel 3(b).

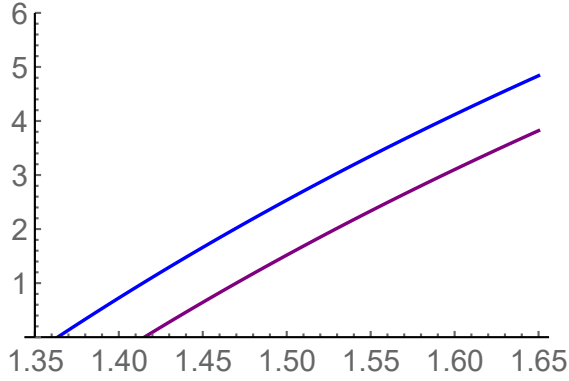
Panel 3(c) considers how the direct gain by a private equity takeover influences the outcome. Naturally, G_{PE} and G_{SB} are important determinants for who takes over and for efficiency for society. The outcome of a takeover game is highly sensitive in G_{PE} and G_{SB} , and these gains are difficult to estimate in practice. However, the important issue is how uncertain the gain difference $G_{PE} - G_{SB}$ is. If the difficulty of estimating G_{PE} is similar to the difficulties when estimating G_{SB} , and if both components are affected similarly by estimation difficulties, then $G_{PE} - G_{SB}$ can be relatively robust. Therefore, we only consider variations in G_{PE} . Intuitively, a higher gain makes it easier for the PE fund to undertake a takeover, and it also provides more leeway for a high return premium. Recall that the PE fund can only play a role if its direct gain is larger than the strategic buyer's. In our base case this occurs as long as G_{PE} is at least 25. This is higher than G_{SB} , but about 19% lower than the strategic buyer's highest possible gain (that is, $U_{A_1} + U_{A_2} + U_Q + G_{SB} = 31$).¹⁸

Panel 3(d) shows the direct effect of the required return premium r . The purple line corresponds to a case with lower information friction $\eta_{sb} = 1.4$. For a given level of information friction, a higher return requirement makes a private equity acquisition more difficult and, eventually, impossible. Hence, the higher the return requirement, the larger must the information friction be, before the PE fund plays a role.

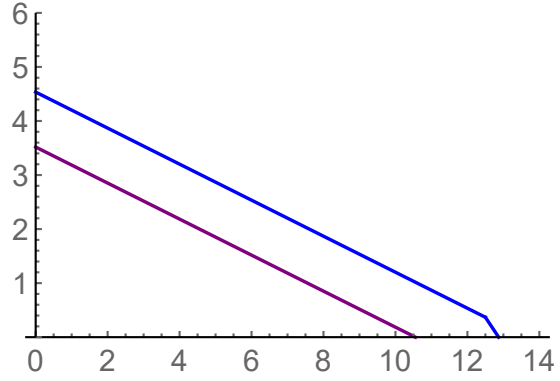
The initial investment cost, I_1 , is usually not decisive in terms of which type of firm takes over the target, cf. (9) and (10).¹⁹ However, Figure 4(a) shows that the second stage investment, I_2 , impacts the PE fund to a larger extent. This is due to the fact that the information friction reduces the sensitivity of the investment cost's present value, see (9), unless the strategic buyer decides to invest even after observing a bad signal. The PE

¹⁸This observation is important when we later evaluate the welfare of PE fund takeovers. Although the PE fund may apparently yield a lower ex post gain than the strategic buyer, and in addition require a return premium, the PE fund can actually be the preferred one to acquire the manager's firm due to better informed investment. The strategic buyer's private benefits also come to play an important role in this comparison.

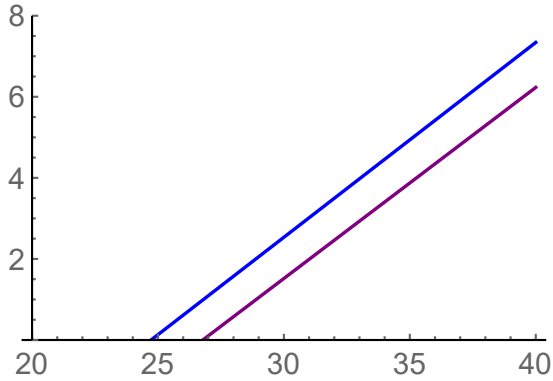
¹⁹The initial investment cost does matter for the firms, cf. (5) and (7), but increasing it will either exclude the firm with the lowest valuation or both firms. Notice that in one case, captured by (11), the strategic buyer does not acquire information, and hence a greater I_1 reduces the advantage of the PE fund.



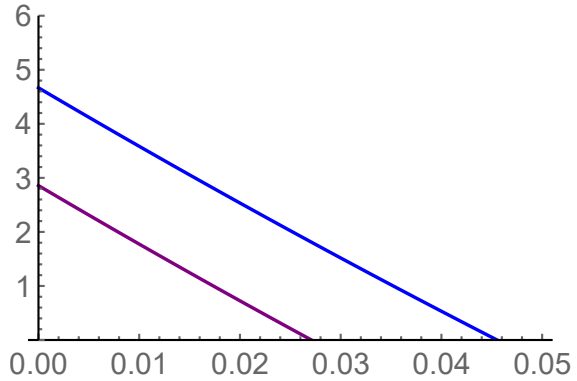
(a) Information friction, η_{sb} . Variation with high return premium, $r = 0.03$.



(b) Private benefits to SB, U_Q . Variation with high return premium, $r = 0.03$.

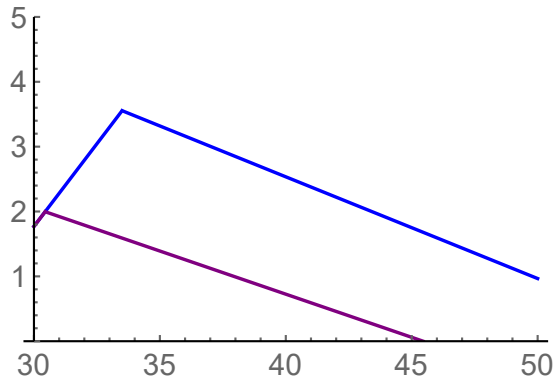


(c) Direct gain of private equity acquisition, G_{PE} . Variation with high return premium, $r = 0.03$.

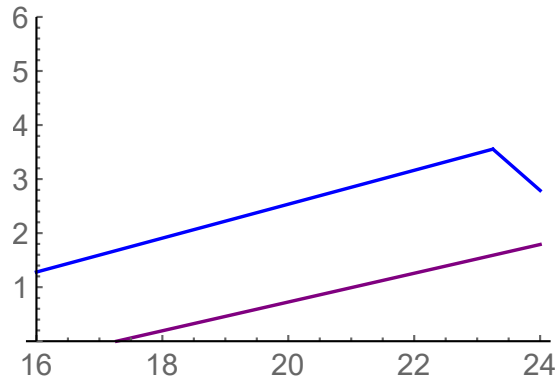


(d) Return premium, r . Variation with low information friction, $\eta_{sb} = 1.4$

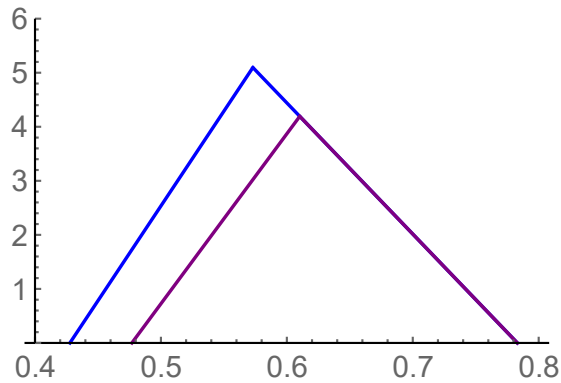
Figure 3: **Condition for a private equity takeover.** The figure illustrates when a takeover by a PE fund takes place; this happens when the value difference is above 0 (all terms collected on the left-hand side in (9)–(11)). The blue line depicts the base case, the purple line depicts a variation with low information friction or high return premium. The base case parametrization is displayed in Table 1.



(a) Investment cost of second stage, I_2 . Variation with low information friction, $\eta_{sb} = 1.4$.



(b) Investment cost in first stage, I_1 , for fixed $I_1 + pI_2$. Variation with low information friction, $\eta_{sb} = 1.4$.



(c) Prior belief, p . Variation with low information friction, $\eta_{sb} = 1.4$.

Figure 4: **Condition for a private equity takeover.** The figure illustrates when a takeover by a PE fund takes place; this happens when the value difference is above 0 (all terms collected on the left-hand side in (9)–(11)). The blue line depicts the base case, the purple line depicts a variation with low information friction. The base case parametrization is displayed in Table 1.

fund’s required rate, r , mitigates this effect, but—as long as the PE fund realistically can play a role—the required rate is typically too small to impact the outcome. The reason for the kink is similar to the reason for the kink when U_Q gets high. When the second stage investment cost gets low enough, the strategic buyer prefers always to invest albeit a low signal is revealed.

To better understand the implications of dynamic investment costs, we perform an analysis in which we keep the PE fund’s expected investment sum $I_1 + pI_2$ constant, and vary distribution of investment costs over time, I_1 and I_2 . Figure 4(b) depicts the effect of this exercise. We now see that a higher stage one investment cost makes it more likely that the PE fund undertakes the takeover. This is due to the fact that as I_2 decreases the present value after making the first investment increases. Since the PE fund has an informational advantage in the second stage, as discussed in relation to Figure 4(a), this advantage thus increases as the initial investment cost accounts for a larger share of the total investment costs. Of course, the PE fund has less to say if the information friction is lower. Indeed, if $\eta_{sb} = 1.4$ the PE fund loses the takeover contest unless the initial investment cost is at least about 15.

The effect of a higher probability of a good signal, prior belief p , is analyzed in Panel 4(c). In the base case, there is kink at $p = 0.57$; for lower information friction at $p = 0.61$. The kink again arises where the strategic buyers change behavior to always invest. Since the PE fund’s key advantage derives from the convexity of payoffs, it is intuitive that the advantage is greater for a somewhat uncertain prior near 50%. This is where information is most valuable.

4 Welfare Implications and Discussions

Our analysis sheds light on the circumstances under which PE funds are beneficial to society. A crucial issue is how society evaluates private benefits and synergies. This depends on the economic meaning embodied in these elements of our theory. Private benefits clearly tempt the target manager and strategic buyer to invest less efficiently, but is this temptation also valued by society? If private benefits are essentially saved efforts which are costly to provide, the PE fund’s elimination of them is a cost borne by the manager—this would naturally be considered as part of welfare. If instead private benefits

are perks spent by the manager, they would often be regarded as excessive and wasteful, with low marginal benefit to society. Likewise, synergy benefits may come from efficiency-enhancing coordination of technological possibilities in a merged firm, or they may arise from anti-competitive conduct with overall loss of welfare.

Thus, in practice, how society evaluates private benefits and synergies is specific to the case at hand and, therefore, we cannot perform merely one comparison. Rather, we introduce three parameters $u_U, u_{gsb}, u_{gpe} \in [0, 1]$ to represent the weight society puts on private benefits and synergies. While u_U is the weight attached to private benefits, u_{gsb} is the weight attached to a strategic buyer's synergy gain, and u_{gpe} is the weight attached to a PE fund's synergy gain.

Given the value of the various strategies we can address which strategy is efficient from society's point of view. Recall from Section 3 that there are three relevant cases to consider with respect to the strategic buyer's investment policy. In the first case this policy is identical to the PE fund's, in the second case the strategic buyer invests in both periods regardless of information, and in the third case the strategic buyer abstains from any investment. Then we have, in parallel with the valuation expressions (4), (5), and (7):

Proposition 2 *If the PE fund takes over, society's value is*

$$p(u_{gpe}G_{PE} + V_{A_1} - I_2) - I_1. \quad (12)$$

If the strategic buyer takes over, and invests like the PE fund, society's value is

$$u_U U_{A_2} + \frac{p}{\eta_{sb}} (u_U U_{A_1} + u_U U_Q + u_{gsb} G_{SB} + V_{A_1} - I_2) - I_1. \quad (13)$$

If the strategic buyer takes over, and always invests, society's value is

$$u_U U_{A_2} + (u_U U_{A_1} + u_U U_Q + pu_{gsb} G_{SB} + pV_{A_1} - I_2) - I_1. \quad (14)$$

If the strategic buyer takes over, but never invests, society's value is

$$u_U U_{A_2}. \quad (15)$$

The special characteristic of private equity funding is highlighted in (12); that is, private benefits play no direct role. Moreover, the return premium—which the PE fund has to satisfy—is from society's perspective merely a distribution mechanism and does thus not influence welfare per se. However, we discuss later that the return premium can lead to welfare implications. For a full discussion of society's benefits, we will soon look closer at

the three cases for the strategic buyer’s investment policy. But first, it is useful to inspect the benchmark where the strategic buyer has no information friction, so that differences are entirely determined by society’s weights on private benefits and synergies.

4.1 No information friction

Suppose the strategic buyer has no information friction, so $\eta_{sb} = 1$. By Assumption 2, the strategic buyer follows the PE fund’s investment policy at time 2. In the interesting case, the strategic buyer also invests at time 1.

The gain to society from a PE takeover instead of acquisition by the strategic buyer, is given by the difference of (12) and (13) with $\eta_{sb} = 1$. This becomes

$$G_{soc} = p(u_{gpe}G_{PE} - u_U U_{A_1} - u_U U_Q - u_{gsb}G_{SB}) - u_U U_{A_2}. \quad (16)$$

This highlights how society’s valuation depends on the synergy gains and the other “indirect” valuation part which can be less valuable to society. For an extreme case, suppose $u_U = 0$. Then society finds a takeover by a PE fund welfare improving if $u_{gpe}G_{PE} > u_{gsb}G_{SB}$. It is plausible that the PE fund is less anti-competitive, so $u_{gpe} > u_{gsb}$. From the discussion of Proposition 1 we know that $G_{PE} > G_{SB}$ is a necessary condition for a PE fund to take over. Thus, a PE fund takeover is necessarily good for welfare when it takes place. On the contrary, private benefits can induce the strategic buyer to have a higher maximum willingness to pay, suboptimally from a welfare perspective. At another extreme, suppose $u_{gpe} = 0$; for example, because the value gain enjoyed by the PE fund derives from tax avoidance. Clearly, the welfare gain (16) is negative, but G_{PE} might be so large that the outcome is a takeover by the PE fund.

One particular way to eliminate the information friction would be if the strategic buyer chose to sell the legacy asset A_2 . That is, if we relax Assumption 3, then W_1 can dominate. This implies that $\eta_{sb} = 1$, but now the strategic buyer enjoys no private benefits from the legacy asset. The last term, $u_U U_{A_2}$ is then dropped from society’s gain (16), increasing this gain all else equal.

4.2 Strategic Buyer Invests like the PE fund

Suppose the strategic buyer optimally adopts the same investment policy as the PE fund, to invest with the outcome of the signal. The PE fund takes over the target when condition

(9) is satisfied. Society's gain from a PE fund's takeover over a strategic buyer's takeover is the difference between (12) and (13), simplifying to

$$G_{soc} = p(u_{gpe}G_{PE} + V_{A_1} - I_2) - u_U U_{A_2} - \frac{p}{\eta_{sb}} (u_U U_{A_1} + u_U U_Q + u_{gsb}G_{SB} + V_{A_1} - I_2). \quad (17)$$

Since $\eta_{sb} > 1$, society generally gains less from the strategic buyer's takeover—the information friction reduces the expected value generated by A_1 . Aside from this effect, the remaining terms are those already discussed in connection with (16).

4.3 Strategic Buyer Always Invests

In contrast, suppose a bad signal implies a high enough conditional probability of a successful second-stage investment for the strategic buyer, so it is optimal to always invest. The condition for the PE fund to take over is given in (10) and society's gain is

$$G_{soc} = p(u_{gpe}G_{PE} - I_2) - (u_U(U_{A_2} + U_{A_1} + U_Q) + pu_{gsb}G_{SB} - I_2). \quad (18)$$

As the strategic buyer invests suboptimally due to the information friction, it would too often spend I_2 to no avail. On the other hand, we have assumed that private benefits U_{A_1} and U_Q accrue regardless of success.

4.4 Strategic Buyer Never Invests

The remaining possibility is that the strategic buyer prefers never to invest. The PE fund takes over if it can dominate the strategic buyer's valuation of the private benefits, see (11). The gain to society from this is

$$G_{soc} = p(u_{gpe}G_{PE} - I_2) - I_1 - u_U U_{A_2}. \quad (19)$$

If the direct gain from the PE fund fully improves welfare, $u_{gpe} = 1$, then a takeover by a PE fund is clearly welfare improving for society. This occurs even if a strategic buyer's private benefits are also seen to fully improve welfare. Furthermore, the higher the return premium, r , is, the more difficult it is for the PE fund to satisfy (11). Hence, as we discuss below, stressing the PE industry by regulating the takeover market leading to increases in r can make takeovers less welfare improving for society.

4.5 Comparison – PE gains valuable to society

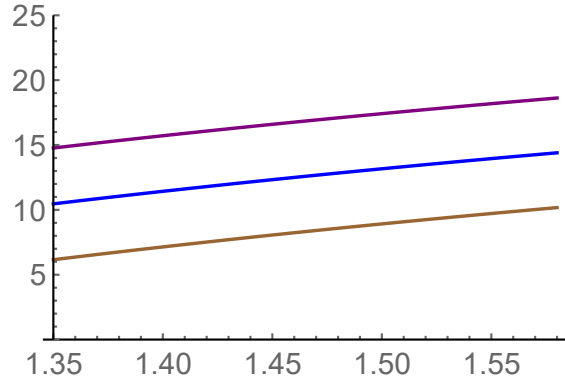
We turn to a broader comparison of a PE fund and a strategic buyer from a welfare perspective. For now we assume that the direct gain obtained when the PE fund takes over is fully valuable to society; that is $u_{gpe} = 1$.

The trade-off in our model between a takeover by a PE fund or by a strategic buyer depends on four central elements. A direct channel is the difference in the synergy gain, $G_{PE} - G_{SB}$. Intuitively, if this synergy gain to a PE fund exceeds that to a strategic buyer, then society has reasons to prefer a takeover by the PE fund. However, such an outcome can be obstructed by the second element, the (excess) return requirement r . Thus, the PE fund's internal contractual arrangement that leads to $r > 0$ can result in a friction for society. A third element is the information friction η_{sb} . This measures the competitive advantage the PE fund has over the strategic buyer, so the gain to society of a takeover by the PE fund is larger, the larger is the information friction. The final element is the weight society puts on the private benefits, also playing a central role in evaluating the efficiency of a takeover by the PE fund. When u_U is close to one, private benefits are assessed as being beneficial for society as well; just as the direct gain the PE fund can provide. Since private benefits are distorted by a PE fund's takeover, a higher u_U makes such a takeover less efficient. We collect the analysis of the various trade-offs below.

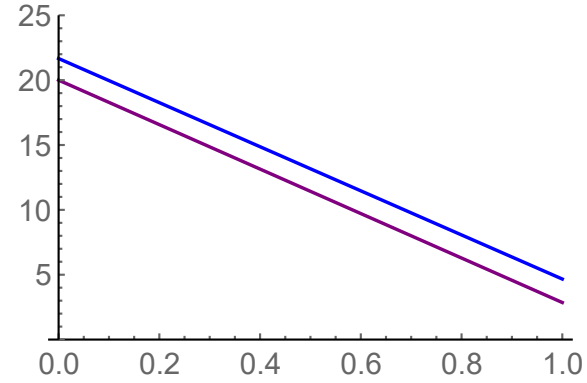
Corollary 1 *Assume the direct gain from a PE fund's takeover is fully welfare improving, $u_{gpe} = 1$. Then Proposition 2 gives us*

1. *If a takeover by the PE fund is possible, i.e., (8) holds, then such a takeover is efficient from society's point of view.*
2. *If society has no value of private benefits, $u_U = 0$, and if the excess takeover gain $G_{PE} - G_{SB}$ and information friction η_{sb} are only moderate, then society incurs a loss due to an inefficient takeover by a strategic buyer.*

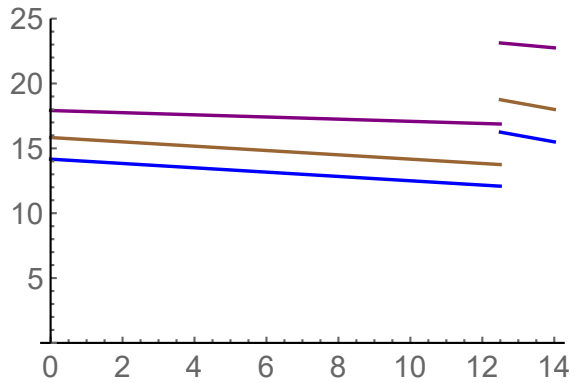
Figure 5 illustrates a number of trade-offs. The effects that a higher information friction and a lower value for society of private benefits increases society's gain of a private equity takeover are intuitive (panels 5(a) and 5(b)). We observe that the sensitivity is fairly high for both parameters, but the impact of the information cost and society's weight on private benefits relies on different channels. This is most easily seen from (17). If the private benefit of the legacy asset is relatively large, which in turn makes the strategic



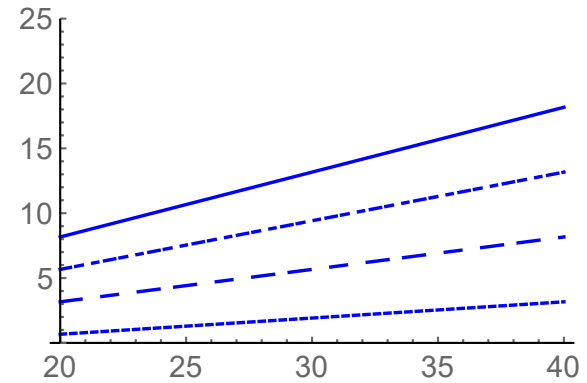
(a) Information cost, η_{sb} . Variation with society's weight on private benefits, $u_U \in \{0.25, 0.50, 0.75\}$ (olive, blue, purple curve). $u_{gpe} = u_{gsb} = 1$.



(b) Society's weight on private benefits, u_U with $u_{gpe} = u_{gsb} = 1$. Variation with low information cost, $\eta_{sb} = 1.4$ (purple curve).

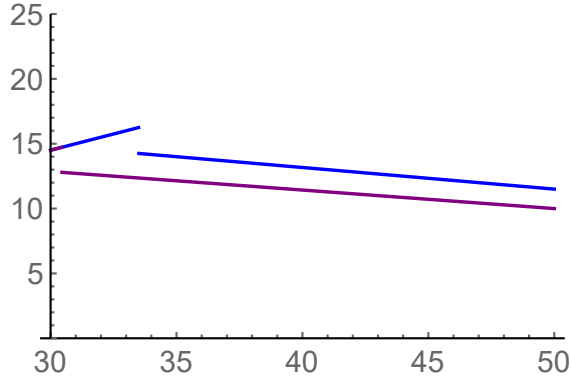


(c) Private benefits to SB, U_Q , with $u_{gpe} = 1$. Variation with society's weight on SB's benefits, $u_U = 0.5, u_{gsb} = 1$ (blue), $u_U = 0.25, u_{gsb} = 1$ (purple), $u_U = 0.5, u_{gsb} = 0.5$ (brown).

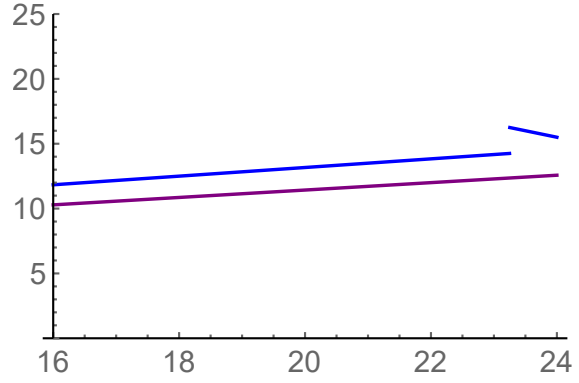


(d) Direct gain of PE acquisition, G_{PE} . Variation with weights $u_{gpe} \in \{0.25, 0.50, 0.75, 1.00\}$ (dotted, wide dashed, dashed, solid). $u_U = 0.5, u_{gsb} = 1$.

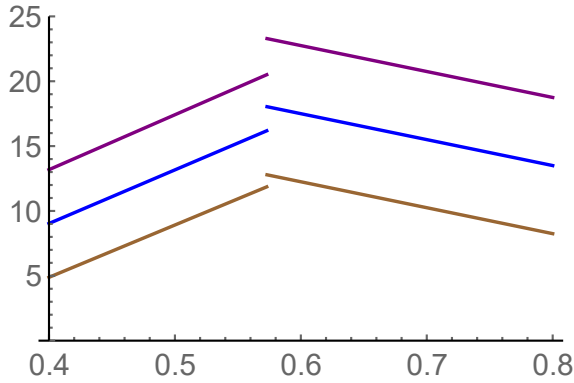
Figure 5: **Gain to society of a private equity takeover**, (17)–(19). The base case parametrization is in Table 1, while social weights u are specified in each panel.



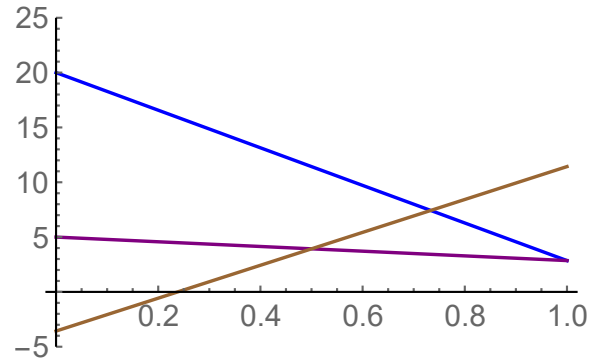
(a) Investment cost of second stage, I_2 , with $u_U = 0.5$ and $u_{gpe} = u_{gsb} = 1$. Variation with low information friction, $\eta_{sb} = 1.4$ (purple curve).



(b) Investment cost in first stage, I_1 , for fixed $I_1 + pI_2$, with $u_U = 0.5$ and $u_{gpe} = u_{gsb} = 1$. Variation with low information friction, $\eta_{sb} = 1.4$.



(c) Prior belief, p . Variation of society's weight on private benefits, $u_U \in \{0.25, 0.50, 0.75\}$ (olive, blue, purple curve). $u_{gpe} = u_{gsb} = 1$.



(d) Social weights, with low information cost $\eta_{sb} = 1.4$. u_U varies, $u_{gpe} = u_{gsb} = 1$, blue curve. $u_U = u_{gpe} = u_{gsb}$ vary, purple curve. u_{gpe} varies with $u_U = 0.5, u_{gsb} = 1$, olive curve.

Figure 6: **Gain to society of a private equity takeover**, (17)–(19). The base case parametrization is in Table 1, while social weights u are specified in each panel.

buyer keep that asset, then society’s weighting is more important. On the other hand, if the strategic buyer’s value to a larger extent stems from combining assets through U_Q and, in particular, G_{SB} , then the information cost is relatively more important.

We know from Figure 3(b) that higher private benefits to the strategic buyer makes it more difficult for the PE fund to take over the target. Figure 5(c) shows (blue curve) that society’s valuation is aligned with this. However, as discussed, for U_Q higher than about 13, the strategic buyer wins and will, in fact, always invest. This is not good from society’s perspective and the gain to society of a private equity takeover jumps upwards.²⁰ Intuitively, these effects are amplified if society attaches lower weight to the strategic buyer’s private benefits ($u_U = 0.25$, purple curve) or synergy gains ($u_{gsb} = 0.5$, brown). That is, private benefits eventually distort the alignment between the strategic buyer and society.

The PE fund’s direct gain, G_{PE} , and return premium, r , play a major role in the PE fund’s ability to attain a higher valuation than the strategic buyer. As discussed above, society can have reasons to prefer the PE fund’s direct gain compared to the strategic buyer’s combined private benefits and synergies. However, this need not be aligned with who acquires the target. For example, for the benchmark parameters the PE fund loses the takeover bid to the strategic buyer when $G_{PE} < 25$. Yet, if $G_{PE} = 20$, a takeover by a PE fund is welfare improving unless society puts very little weight on the PE fund’s direct gain, see Figure 5(d).²¹ Furthermore, from Proposition 2 we see that the return premium does not directly impact welfare. However, recall from Figure 3(d) that the PE fund loses the takeover bid if $r > 0.045$ ($r > 0.027$ if $\eta_{sb} = 1.4$). Thus, internal contract issues or regulatory initiatives which in effect increase the return requirement makes a takeover from a PE fund less likely and can, as in this case, decrease society’s welfare.

Figures 6(a) and 6(b) provide the welfare analysis of the dependence on investment costs that we analyzed in Figures 4(a) and 4(b). Jumps again occur where the strategic buyer always invests because I_2 is low—this is inefficient behavior, so society’s gain from

²⁰While curves in Figures 3 and 4 exhibited kinks where the strategic buyer changes behavior, in Figures 5 and 6 the curves exhibit jumps. This is because the former figures involved the strategic buyer’s own evaluation, while the latter figures involve society’s evaluation of the strategic buyer’s behavior.

²¹Alternatively, if the strategic buyer’s private benefits are highly valuable in terms of welfare, $u_U = u_{gsb} = 1$, then even with moderate weight on the PE fund’s gain, $u_{gpe} = 0.5$, society is indifferent between a takeover by a PE fund or a strategic buyer when $G_{PE} = 25$. This straightforward case is not depicted in the figure.

a private equity takeover jumps up. On the other hand, as long as both parties follow the same investment policy, the direct effect of raising I_2 is worse for private equity ownership, since the PE fund's signal leads it to (efficiently) invest more often.

Changing the prior probability of success again has a non-monotonic effect, see Figure 6(c). As discussed in relation to Figure 4(c), the value of information is greater for intermediate values of this prior, and society shares this point of view.

The final Figure 6(d) emphasises the point that the welfare evaluation is highly dependent on our specification of social weights, and we elaborate on this in the next section.

4.6 PE Fund Takeover Decreases Welfare

Our framework is rich enough to also demonstrate cases in which a PE fund's takeover decreases welfare. The worst case for society is if the PE fund's gain is only due to welfare distorting actions. Depending on the situation at hand, the buy-and-build strategy can be such a case because the creation of a dominating market player can distort competition. Furthermore, PE funds typically create their takeovers with highly levered project-only funding. This provides a foundation for tax shields. Tax shields may be regarded as a matter of redistribution and need not directly impact welfare, although tax avoidance may raise society's cost of raising funds for public expenditure. More obviously, consider a cross-border context. If the PE fund can redistribute income from a tax-shield supporting country to a country with lower tax burden, then the tax-shield supporting country experiences negative welfare from a PE takeover. To consider such examples we analyze the implications of u_{gpe} in Figure 6(d). In the benchmark case the PE fund's gain is highly valuable to society (blue curve, $g_{gpe} = 1$). We compare this case with that in which society's weighting of private benefits or indirect gains varies equally ($u_{gpe} = u_U = u_{gsb}$). As the weighting increases, a takeover by the PE fund becomes less welfare improving to society. This is because we assume that the direct gain caused by a strategic buyer's takeover is fully valuable in terms of welfare. Interestingly, in the extreme case in which society's weighting is zero on all private benefits and synergies ($u_{gpe} = u_U = u_{gsb} = 0$), society prefers a takeover by the PE fund. This follows from (17):

$$G_{soc} = p \frac{\eta_{sb} - 1}{\eta_{sb}} (V_{A_1} - I_2). \quad (20)$$

As long as there is an information friction, society prefers the investment decision is undertaken by the PE fund.

At another extreme, if we allow the strategic buyer's private benefits to contribute to welfare by 50% and the synergies by 100% ($u_U = 0.5, u_{gsb} = 1$), then a PE fund's takeover can be welfare decreasing. This is seen with the brown curve in Figure 6(d), when u_{gpe} is low. An example of this is if the PE fund is improving profits only by undermining competition.

5 Extensions

To make the analysis as simple as possible, we have made a number of assumptions. This section explores the robustness of our results under relevant alterations to the model.

5.1 Outside Investors

Our analysis so far has assumed that all three main player types possess sufficient funds to make both investments if they own the firm. We now relax this assumption, and assume some players need to approach outside investors. As we explain in greater detail below, we do not consider this relevant for PE funds in our model—they make efficient investment from outside investors' point of view, and furthermore, the return requirement $r \geq 0$ might be seen as capturing a friction cost of funding. For the other two players, the effect of needing outside investors is more comparable. We will elaborate on the simplest case, where the manager needs outside funding, but similar analysis applies if the strategic buyer needs it. In section 5.1.5 below, we will return to discuss the overall implications for our takeover game and welfare.

5.1.1 Contracting

Suppose that the manager has no liquid funds, for the purpose of developing asset A_1 . We assume that outside investors are willing to inject capital as long as their net present value of doing so is at least zero. The manager can offer a contract to the investors, specifying the payments made by the investors and the cash flow to return. The manager has limited liability, so there is no stage in which the manager earns less than zero.²² Also, private

²²This normalization to zero plays no qualitative role for our results.

benefits U_{A_1} and U_{A_2} are truly private, so they cannot be pledged for repayments to outside investors.

We can imagine three relevant cases on how contracts can be enforced. In all cases, it must be a contractible outcome whether asset A_1 provides the successful cash flow V_{A_1} , implying that both investments have been made in both stages and $\theta = 1$. This is the only positive cash flow that can be promised for repayment. In the first case, the manager's investment choices and signal are all contractible—this allows for a trivial, frictionless contract where the manager behaves precisely as if the funds were privately available. In the second case, which we will analyze in detail, the contract can only depend on whether each of the two investments have been made. In the final case, the contract cannot depend on investments or signal realizations—we consider this less realistic, and its effect would only be to exacerbate the frictions that we already obtain in the second case. So, we continue with the assumptions of the second case.

It should be noted that the manager will not offer a contract unless it offers a gain. This will be the case as long as a limited-liability contract is feasible and both investments are made in some contingencies. Further analysis depends on whether the manager keeps A_2 , thereby incurring the information friction $\eta_m > 1$.

5.1.2 Both Assets Kept

Assume thus that the manager keeps A_2 and contracts with outside investors. The manager's signal is not contractible, but both the initial investment in the growth option and the decision to continue are contractible. Value can be generated only with successful investment, so a contract requires the investors to provide the initial I_1 as well as the additional I_2 if the manager decides to continue.²³

Since the manager's signal is private, there is an incentive constraint. The manager obtains private benefits U_{A_1} from continuation regardless of the true state, but the chance of obtaining the pledgable V_{A_1} from continuation depends on the signal. The contract needs to incentivize the manager to drop investment I_2 if investment has too low a chance to compensate investors. The contract therefore specifies that investors provide compensation $C \geq 0$ to the manager in case the project is terminated.²⁴ This creates an information

²³If the manager does not undertake the first investment, amount I_1 must be returned to investors and the relationship ends. We deal with the second investment in the following.

²⁴The manager thus returns $I_2 - C$ to investors if the second investment is not made.

rent that can be the root cause of frictions in the contracting relationship.

The only cash flow going back to investors is a fraction $\alpha \in [0, 1]$ of the final cash-flow sV_{A_1} . The outside investors accept any contract where their present expected net cash flow is non-negative. The manager designs contract parameters α and C to maximize own expected utility, subject to investor participation.

If the contract specifies termination at signal $s = 0$, the incentive constraint is

$$\frac{p\eta_m - p}{\eta_m - p} (1 - \alpha) V_{A_1} + U_{A_1} \leq C. \quad (21)$$

Lemma 4 *The optimal contract depends on whether termination is efficient after receiving a low signal.*

Case a: If $U_{A_1} + \frac{p\eta_m - p}{\eta_m - p} V_{A_1} - I_2 \leq 0$, it is inefficient to invest if $s = 0$. It is possible to obtain financing from outside investors if and only if

$$\frac{p}{\eta_m} (V_{A_1} - I_2 + U_{A_1}) \geq I_1 + U_{A_1}. \quad (22)$$

Case b: If instead it is efficient to continue when $s = 0$, then the manager contracts with the outside investors if

$$pV_{A_1} - I_1 - I_2 \geq 0. \quad (23)$$

If (23) does not hold, the manager cannot make a contract with the outside investors and continues as a stand-alone.

Since outside investors obtain zero expected profit, it is easy to calculate the manager's expected utility. When outside financing is impossible, it is U_{A_2} . When possible, and the efficient contract induces termination if $s = 0$, the manager's expected utility is

$$\frac{p}{\eta_m} (V_{A_1} - I_2 + U_{A_1}) - I_1 + U_{A_2}. \quad (24)$$

If it is efficient to continue when $s = 0$, then the manager's expected utility is

$$U_{A_1} + U_{A_2} + pV_{A_1} - I_1 - I_2. \quad (25)$$

5.1.3 Initial Asset Sale

We also consider the possibility that the manager initially sells A_2 for the value of 0. The manager loses the benefit U_{A_2} , but gains that inference regarding A_1 is easier. Lemma 4 carries over, by setting $U_{A_2} = 0$ and $\eta_m = 1$ in the Lemma. Since the manager now receives

a precise signal regarding the random state, only the case with termination with $s = 0$ is relevant. The exact condition for the possibility of OI funding with one asset is thus

$$p(V_{A_1} + I_2 + U_{A_1}) \geq I_1 + U_{A_1}. \quad (26)$$

Since (22) implies (26), this financing condition is easier to satisfy. If contracting is possible in this case, the manager's utility becomes

$$p(V_{A_1} - I_2 + U_{A_1}) - I_1. \quad (27)$$

5.1.4 Comparison

To conclude, outside funding is feasible when (26) holds. If also (22) holds (or (23) if η_m is high enough), the manager can choose between selling or keeping the additional asset A_2 . Assuming it is efficient to terminate the contract when $s = 0$, a comparison of (24) to (27) yields that the manager prefers to sell the additional asset A_2 precisely when

$$U_{A_2} \leq (\eta_m - 1)(V_{A_1} - I_2 + U_{A_1}). \quad (28)$$

Intuitively, if the private benefits of keeping the legacy asset are small relative to the information cost, then the manager prefers to sell the legacy asset. If it is not efficient to terminate the contract after a low signal, a comparison of (25) to (27) reveals that the manager never prefers to sell the asset A_2 .

In practice, it can be difficult to write a contract with the outside investors which rewards the manager a compensation if he terminates at an intermediary stage. To consider this, suppose the contract can only return a share α to the investors; that is, $C = 0$. This can be thought of as equity or debt which in our setup is similar. The case corresponds to case b in Lemma 4 and the manager's expected utility is as in (25). Note that if case a in Lemma 4 prevails, then the manager is better off with the contract having $C = U_{A_1} + U_{A_2}$. If the information friction is sufficiently high so that the signal is irrelevant for the investment decision, then having $C = 0$ is efficient.

5.1.5 Discussion

To summarize, if the outside investors are restricted in terms of offering compensation, C , then the manager can be worse off compared to analysis in Section 3. However, since the manager's access to outside investors does not affect neither the strategic buyer's valuation

nor the private equity fund's valuation, extending the analysis to include outside investors does not have any direct effect on our previous analysis of the outcome and efficiency of the takeover game between a strategic buyer and a PE fund.²⁵

A similar concern deals with the matter of the private equity fund's options as well as the strategic buyer's options to fund the takeover and subsequent investments. With respect to the private equity fund we have assumed that the return requirement r proxies for the cost of setting up an efficient contract within the funds; that is, between the general partner and the limited partners. The subsequent funding is in practice most often done with a minor share consisting of equity from the fund's committed capital and a major share consisting of newly issued debt based on the assets in the acquired firm; that is, a levered buyout. In our analysis we assume that the PE fund's debt can be issued without fictions due to reputation costs for the PE fund, if investors subsequently infer that the PE fund misbehaved when issuing debt. Thus, absent from tax effects, outside investors have been considered with respect to the PE fund.

The need to fund with outside investors is a more delicate concern when it comes to the strategic buyer. Restricting the strategic buyer to fund with outside investors would imply a trade-off involving private benefits as well as cross-subsidization with the strategic buyer's pre-takeover assets. If an investment-efficient contract with outside investors—from the strategic buyer's point of view—can be obtained, then the analysis is as in Section 3. If not, the strategic buyer would be limited in the contest with the private equity fund; that is, the intrinsic maximum willingness to pay can be larger than what can be supported by funding from outside investors. Thus, in this case private benefits can make it more challenging for the strategic buyer to win over the private equity fund, whereas with private benefits for a deep-pocket strategic buyer makes it more likely that such a firm acquires the manager's firm.

5.2 Private Equity Fund's Acquisition of Two Firms

A natural role of PE funds is to mitigate information frictions in a portfolio of firms. This role is often more difficult for strategic buyers to fill out, so PE funds can improve welfare this way. However, even for PE funds this can be difficult. Typically, candidate firms

²⁵There would potentially be an effect if these two parties were in a more complex bargaining situation with the manager, and their bargaining strengths were unequal.

do not come up for sale at the exact same time. In particular, acquiring the first target with a merger in mind, there is uncertainty whether a suitable partner to the target will become available within a reasonable time horizon. The PE fund's return requirement is particularly challenging, as it adds to the time pressure.

5.3 Information Regarding Takeover Gains

We have assumed that there is perfect information regarding the gains G_{PE} and G_{SB} . A classical issue in takeovers is how to convince the incumbent shareholders to sell their shares to a raider who can improve the value (e.g., Grossman and Hart, 1980; Shleifer and Vishny, 1986). Clearly, we could consider a more complex model in which the bargaining game between the manager and the PE fund is more elaborate, or we could introduce asymmetric information regarding the size of the gains. In the latter case, the expected gains would be the central ingredient (perhaps conditional on the takeover offer being profitable to the PE fund), and we would get some further conditions for when a private equity takeover is possible. However, we do not see that these conditions change the first-order effects seen in our model, and thus we disregard this more complex setting to have a tractable model.

6 Conclusion

Firms with a potential for value creation are limited in exploiting their growth opportunities, if they are subject to information frictions. Private equity funds and strategic buyers compete about acquiring such firms. Following an acquisition, the two types of buyers vary in their ex post strategies. Due to the framework in which private equity funds are set up, they have a relatively short time horizon for getting verifiable signals supporting improvements. This leads to immediate termination of loss-making projects and potentially mergers with similarly restructured constrained firms. This provides a specific role for private equity funds in realizing gains. In contrast, a strategic buyer focuses on integrating the acquired firm into the existing business plan. This difference leads to different incentives.

We show under which conditions private equity funds have a competitive advantage in acquiring constrained firms with a potential. Private equity funds are well poised to

acquire the target, unless the competing strategic buyers can avoid information costs and are able to obtain synergy gains of a magnitude that is at least comparable to the potential value unleashed by private equity funds.

Since the activities of private equity funds are highly debated, we also consider welfare effects from a broader societal perspective. We find that when takeovers by private equity funds take place, then they often improve society's welfare. We also highlight that high return requirements within private equity funds can crowd out takeover opportunities pointing towards a potential loss for society. Thus, private equity funds may serve as a means to mitigate information frictions.

A Appendix

A.1 Proof of Lemma 1

Proof. If the maximum in the second term is zero, it follows from Assumption 2 that W_2 locally decreases in η_{sb} . If the maximum is positive, then $W_2 = U_{A_1} + U_Q - I_2 + p(V_{A_1} + G_{SB}) - I_1$ which is locally constant in η_{sb} . If η_{sb} is a critical point where the maximum switches from zero to positive as η_{sb} , note that W_2 switches continuously from the decreasing to constant part, establishing the desired monotonicity of W_2 . Thus, W_2 is never greater than its limit for $\eta_{sb} \rightarrow 1$, where W_2 converges to W_1 . ■

A.2 Proof of Proposition 1

Proof. The result follows directly from analysis of condition (8). All mentioned parameters enter on one side of the condition only, so the claims are simple to verify. Only changes of parameters consistent with the assumptions should be considered. ■

A.3 Proof of Corollary 1

Proof. When $u_{gpe} = 1$, comparison of (7) with (12) shows that society places no smaller value on the PE fund's ownership than it does privately. On the other hand, comparison of (5) to (13)–(15) shows that society places no greater social value on the strategic buyer's ownership than it does privately. It follows that society prefers PE fund ownership whenever its private value exceeds that of the strategic buyer, i.e., whenever it wins the takeover competition. For part 2, notice that with $u_U = 0$, the strategic buyer values its ownership of the target discretely higher than society does. For parameter constellations where the strategic buyer narrowly wins the takeover competition, society incurs a loss. ■

A.4 Proof of Lemma 4

Proof. Case a. Since it is inefficient to invest if $s = 0$, the manager will choose C to satisfy incentive constraint (21) with equality. Then α must be determined by the outside

investors' zero-profit condition,

$$\begin{aligned}
0 &= \frac{p}{\eta_m} (\alpha V_{A_1} - I_2) - \frac{\eta_m - p}{\eta_m} C - I_1 \\
&= \frac{p}{\eta_m} (\alpha V_{A_1} - I_2) - \frac{p\eta_m - p}{\eta_m} (1 - \alpha) V_{A_1} - \frac{\eta_m - p}{\eta_m} U_{A_1} - I_1 \\
&= p\alpha V_{A_1} - \frac{p}{\eta_m} I_2 - \frac{p\eta_m - p}{\eta_m} V_{A_1} - \frac{\eta_m - p}{\eta_m} U_{A_1} - I_1,
\end{aligned} \tag{29}$$

where the first equality followed from replacing C from the binding (21), and the second collected terms. Obviously, $\alpha > 0$ is necessary to satisfy (29). On the other hand, (29) can be solved with $\alpha \leq 1$ if and only if

$$pV_{A_1} \geq \frac{p}{\eta_m} I_2 + \frac{p\eta_m - p}{\eta_m} V_{A_1} + \frac{\eta_m - p}{\eta_m} U_{A_1} + I_1, \tag{30}$$

equivalent to (22).

Case b. There is no incentive constraint, and $C = 0$, so the outside investors' zero-profit condition becomes

$$0 = p(\alpha V_{A_1} - I_2) - I_1, \tag{31}$$

which can be solved for $\alpha \in [0, 1]$ if and only if (23) holds. ■

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