Abstract

Within the great oscillations of overall merger activity there is a shifting pattern of activity between strategic (operating firms) and financial (private equity) acquirers. What are the economic factors that drive either financial or strategic buyers to a more dominant position in M&A activity? While equity misvaluation can explain waves of M&A activity, it implies a simultaneous dominance of strategic acquirers using overvalued stock. However, this fails to match the data as relative peaks of strategic/financial activity do not correspond with stock market peaks. In this paper we introduce the role of debt market misvaluation in M&A activity. The role of debt market misvaluation might seem limited since both types of acquirer can access misvalued debt markets. However, the fundamental difference between financial and strategic acquires lies in their corporate governance and the insurance effect of combining strategic assets. We examine how moral hazard and the insurance effect interact with potential misvaluation of debt, leading to the dominance of financial vs. strategic buyers that depend on debt market conditions.
**Introduction**

Mergers and Acquisitions occur in great waves of activity with recent troughs, for example, of only a few thousand deals in 2003 and peaks of over ten thousand deals in 1999 and 2006.\(^1\) Within this oscillation of activity there is another shifting pattern: the percentage of so called financial sponsors (private equity firms) vs. strategic buyers (operating companies) seems to ebb and flow.

Figure 1 examines the financial sponsor vs. strategic proportion of M&A activity of all public targets with values less than $1 billion recorded in the SDC Platinum data base from 1985-2008.\(^2\) It is immediately clear that the fraction of total deal value acquired by financial sponsors has varied dramatically over the last 25 years. This same pattern is true across many industries and geographies.

![Figure 1: US M&A Volume ($10M-$1B) Financial vs. Strategic](image)

Any particular transaction has many factors that drive the ultimate acquirer’s willingness to pay. And many theories propose reasons why particular firms or industries may be ripe for acquisition activity.\(^3\) However, the broad pattern of financial sponsor activity that spans industries and geographies at a given point in time suggests a broad economic explanation for the coordination. Little research directly considers financial versus strategic buyers. Müller and Panunzi (2004) and Morellec and Zhdanov (2008) examine the leverage of financial buyers but they do not consider potential strategic

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\(^2\)Private equity firms are limited in the size of checks they can write to buy a firm by the amount they have under management and covenants with their investors, called limited partners or LPs. Both strategic and financial buyers can reasonably acquire public targets with values less than $1 billion. Increasing the target size cutoff dampens the percentage of PE activity in every period, but the increases and decreases in activity are still evident. We also removed deals less than $10M as a standard screen. The C&I spread is the commercial and industrial loan rates minus the federal funds rate.

buyers. Recent working papers by Bargeron et al. (2008), Hege et al. (2010), and Dittmar et al. (2009) focus on bidding behavior and target premiums between strategic and financial acquirers. A recent working paper, Gorbenko and Malenko (2009), considers the bidding behavior of strategic vs financial bidders focusing on how synergies cause different bidding behavior than the search for undervalued assets. Jensen (1986) famously argues that free cash flow determines which firms are taken over by LBOs. And Holmstrom and Kaplan (2001) document and discuss the LBO wave in the late 1980s. However, no research that we know of offers any broad insights into the rising and falling tides of private equity activity through the different merger waves.

What drives either financial or strategic buyers to have a more dominant position in M&A activity at different points in time? This question is important not only because the economic magnitude of this activity is so large, but also because the balance of power between financial vs. strategic acquirers changes the ownership structure of assets and alters the incentives and governance mechanisms that surround the economic engine of our economy.

One potential broad economic mechanism that would imply a shifting willingness to pay by strategic investors stems directly from previous work done on merger waves. The theories of Rhodes-Kropf and Viswanathan (2004) and Shleifer and Vishny (2003) both suggest that overvalued acquirers will bid more than undervalued acquirers and overvalued targets are more willing to accept takeover offers, leading to waves of M&A activity during overvalued markets. Strong support for the misvaluation theory has been found by Rhodes-Kropf et al. (2005), Ang and Cheng (2006), Dong et al. (2006) and others. But clearly, financial buyers who must pay in cash should avoid overvalued targets. This implies that patterns of financial vs. strategic activity could be driven by the same phenomenon. However, a quick look at figure 1 suggests that something else must be at work as the local peaks of financial sponsor activity relative to strategic activity correspond with stock market peaks such as the late 90s and 2006-2007, with dips in the early 90s and 2001 recessions.

Harford (2005) shows that interest rates, specifically the spread between the average interest rate on commercial and industrial loans and the Federal Funds rate, are significantly inversely correlated with merger activity as can be seen in Figure 1. Although Harford (2005) proposes no formal theory of merger activity, he argues that this spread is a proxy for overall liquidity or ease of financing.

In this paper we combine the results from Harford (2005) with the ideas of the misvaluation hypothesis and explore how the possibility of misvalued debt markets can both fuel merger activity

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4Bargeron et al. (2008) report that target shareholders receive a 63% higher premium when the buyer is a strategic vs private equity firm, while Hege et al. (2010) models the decision of private equity firm to bid for corporate assets and report evidence that private equity deals generate greater seller returns. Dittmar et al. (2009) report that when a corporate acquirer competes with a financial rather than a corporate bidder, the acquirer pays a significantly lower premium and earns a significantly higher abnormal return.

5Academic work as well as the lay press suggest that there are potentially many different costs and benefits of public vs. private ownership. The difference can alter incentives, promote a long or short run focus, allow for tighter monitoring and less shirking, etc.
and alter the balance between PE and strategic buyers.

While it seems reasonable that if equity markets can be misvalued then so can debt markets, it is much less obvious that “cheap” debt should lead to more acquisition activity. After all, the targets can also access cheap debt and so are more valuable as stand-alone entities when debt is cheap. On top of this, it is not clear how debt misvaluation should alter the interplay between financial and strategic buyers. Just believing that debt markets are overvalued does not imply a benefit to one type of buyer. After all, if both types of acquirers find a misvalued debt market, cannot both take advantage of it? Since it is not ex-ante obvious what misvalued debt might do to the M&A market or how it would differentially impact the participants, our model provides important insights and understanding.

Our approach is based on a model of PE and strategic merger activity in which all players in the model make value maximizing decisions conditional on their information. Misvaluation can stem from asymmetric information between PE firms, managers, and investors à la Myers and Majluf (1984), similar to Rhodes-Kropf and Viswanathan (2004), or misvaluation can be irrational in nature (similar to Shleifer and Vishny (2003)). In this paper, we take the potential for managers and bondholders to have different viewpoints on valuation as a given and see where that leads, without taking a particular stand on the cause of such difference.

While we assume that each type of buyer and the target can equally access the debt market, there exist fundamental differences that alter the benefit to each. Strategic buyers have a current project (or projects) they are considering combining with the target, while financial sponsors evaluate the target as a stand-alone project. Anytime less-than-perfectly correlated projects are combined, there is an insurance effect on debt. This effect was first proposed by Lewellen (1971) and then extended by Higgins and Schall (1975) and Galai and Masulis (1976) and has been repeatedly considered in the financial literature both empirically and theoretically. For example, see Kim and McConnell (1977) for an early empirical examination of the insurance effect on debt prices after mergers, while Leland (2007) completes an in-depth theoretic examination, and Faure-Grimaud and Inderst (2005) considers the effect of uncorrelated projects in the context of mergers. We build on this work to examine how the insurance effect interacts with the potential misvaluation of debt claims even when agents are risk neutral.

Imagine that the interest rate is too high because investors have overestimated the probability of project failure. Investors will then think that combining two uncorrelated projects will have a much larger insurance benefit than it actually will. In other words, they will think combining projects improves the debt payout relative to the equity more than it does. On the other hand imagine the interest rate is too low because investors have underestimated the probability of project failure. Investors will then think that combining two uncorrelated projects will have a more limited insurance
benefit than it actually will. Therefore, while both strategic and financial buyers would like to take advantage of interest rates that are “too low” and avoid borrowing when interest rates are “too high” they are differentially impacted by the errors and are willing to pay relatively more or less depending on the sign of the error made on interest rates.

Financial sponsors are better able to take advantage of interest rates that are too low because strategics are diversifying and therefore minimizing the error investors make. While strategics are less hurt by interest rates that are too high because diversification is highly valued when project failure rates are expected to be high.

Misvaluation will also potentially alter the moral hazard problem faced by investors in the firm. In which case the governance of a financial buyer relative to a strategic buyer will potentially create another reason why financial buyers may dominate in overvalued debt markets. To the extent that misvaluation makes the moral hazard problem worse and PE firm oversight is a better governance structure, then PE buyers will be able to create more value in misvalued debt markets than strategic buyers. The joint presence of moral hazard and misvaluation yields interesting insights and allows us to contribute at a methodological level to the literature by analyzing an agency model with asymmetric information between investors and managers.

Overall, the potential for misvalued debt has a number of interesting empirical implications. First and foremost, the possibility of misvalued debt not only changes the likelihood of an acquisition, it also changes the type of buyer and the way the assets are owned. This prediction has empirical content because although the knowledge that the debt market is under or overvalued may be impossible to possess in real time, looking backward we should find that times when credit was particularly easy correspond to increased M&A activity and increased PE activity relative to strategic buyers. Furthermore, the level of activity of financial buyers in aggregate in the economy will correlate with default probabilities. Financial buyers will be more active and take on more debt than strategics when debt is overvalued. Thus a surprisingly large number should end up in financial distress.

Second, although the possibility of overvalued debt may help financial buyers win the target, overvalued debt may not help financial buyers’ returns. Overvalued debt increases all financial buyer’s willingness to pay, but competition may cause the gains to go to the target. Since PE firms are more likely to win in overvalued credit markets, they should use more leverage and pay higher prices. Axelson et al. (2010) find support for this idea and report that credit market conditions affect the prices paid and are the main driver of the quantity of debt used in buyouts. Furthermore, Axelson et al. (2010) find that highly levered transactions are associated with lower fund returns. Furthermore, Hege et al. (2010) report that sellers of assets to PE buyers earn positive returns significantly greater than in sales to public operating firms.

Third, if debt maturities are shorter than the investment horizon of the project, then a PE firm
must impound its forecast of the future expected misvaluation of debt markets into its willingness to pay today. An expectation of future overvaluation may lead a PE firm to pay a higher amount today and borrow more. Then, if debt markets shift from over to undervalued, it may turn out that the financial buyer paid significantly more than the investment is now worth given that it has to be refinanced with undervalued debt. This was not a mistake ex-ante, given debt prices, but will lead to the possibility of sudden collapses ex-post that are not related to a change in the health of the underlying acquired firm. Furthermore, the larger the original debt market misvaluation the larger the resulting financial distress. Therefore, depending on the costs of financial distress, the underlying target firm may be impacted in a way that would not have occurred if debt markets were always correctly valued.

Finally, to the extent that the assets of a strategic acquirer are highly correlated with those of the target, the insurance effect should dissipate. Therefore, strategic buyers should be more competitive with financial buyers for targets with assets that are more similar to the acquirer’s current assets. The strategic acquirer will face a lower penalty due to the misvaluation of the insurance effect when the insurance effect is known to be limited.

Together these implications suggest that the possibility of misvalued debt may have important impacts on both firms and investors, on who buys whom, and for default levels in the economy. We hope these ideas guide future empirical work to some interesting findings.

The remainder of the paper is organized as follows. The basic model is developed in Section I. The willingness-to-pay of different organizational forms is determined in Section II. Section III will present the results of comparing the different organizational forms. Section IV contains a discussion of the main ideas in the paper and some extensions. Section V concludes.

I. The Model

A. Managers and Private Equity Partners

The basic set up comes from the workhorse model of Holmstrom and Tirole (1997) with some interesting additions. This model has been used to model the effect of financial intermediaries such as banks and private equity firms on aggregate investment when there are financing constraints. We base it on this model to more easily connect the results to the literature and also because it provides a straightforward way of modeling governance issues among the different types of organizational forms.

The economy consists of three types of agents: managers, private equity partners, and investors. They differ in both their abilities to generate returns and their information sets, in a way that will be clear shortly. All agents are risk-neutral.

There is a project for sale with a current manager, who owns the project, and there are two
potential buyers of the project: a PE firm (who joins with a manager), and a manager with a current project (a merger or strategic acquirer). Whether or not the project is purchased it requires an investment $I$ (in period 1) to realize its return (in period 2). In period 2, the investment generates a verifiable return equaling either 0 (failure) or $R$ (success). The magnitude of the success depends on how the project is managed. A stand-alone project returns $R$, a project with a PE partner who monitors the project, returns $R_{pe}$, and a project together with another project returns (with synergies $\geq 0$), $R_s$ per project.

The probability that the project succeeds (and returns $R, R_{pe}$ or $R_s$) is either $p_H$ or $p_L$ ($\Delta p = p_H - p_L > 0$) depending on the manager’s project choice (or equivalently effort choice). Projects are run by managers who receive private benefits of 0, $b$ or $B$ where $0 < b < B$. Projects with a private benefit of $b$ or $B$ have a low success probability of $p_L$ while the ‘good’, high probability, projects have no private benefits. This can be interpreted either as reduced/increased effort affecting probabilities of success, or as a managerial pet project with higher private benefits but lower expected returns. Thus, without proper incentives managers will choose lower expected return projects with higher private benefits. We assume that investors require a return $\gamma$ and that only the good projects are economically viable, i.e.,

$$p_H R^i - \gamma I > 0 > p_L R^i - \gamma I + B, \forall i \in \{\emptyset, pe, s\}$$

The potential benefit of including a private equity investor in the project is that PE firms can monitor the project and change the return to $R_{pe} \geq R$ and prevent the manager from choosing the high private benefit, $B$, project. However, PE firms must pay a cost, $c > 0$, to monitor and will therefore only monitor if they have the incentives to do so.

Potential buyers of the project are willing to pay up to a maximum value $V_{pe}$ if they are a PE firm, or $V_s$ if they are a manager with another project (strategic acquisition with synergies). The stand-alone manager values the project at $V$ which is just the highest amount they could extract from the firm if it is not sold. The price paid by a buyer is for the right to invest $I$ in the project. Therefore, the total amount needed for the project is $V^i + I$. The buyer may pay for the project and the needed investment with either the cash they posses or by raising money from investors. Managers (with or without another project) have capital $A_m$ and PE investors may choose to invest capital $A_{pe}$. In order to focus on the interesting case when outside investors are needed we will assume that $A_m + A_{pe} < I$.

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6 We assume the selling manager is as informed as potential buyers or requires all cash for exogenous reasons so nothing is learned from the seller’s choice to sell or by their decision not to accept contingent claims. See Fishman (1989) and Hansen (1987) for interesting papers on the role of the medium of exchange in acquisitions under asymmetric information between a target and competing bidders.

7 PE firms have set fund sizes that depend on the capital they have raised and are restricted in the percent of the fund they can allocate to one investment. We will see that if monitoring skill is scarce then PE firms will always want to allocate the minimum to any investment in order to maximize the return to monitoring. Thus, $A_{pe}$ will be determined endogenously in the model.
We assume that there are infinitely many investors who do not monitor and demand an expected return of $\gamma$.\(^8\) Since an optimal contract in this setup pays investors first and gives the residual to those who need incentives, we will often refer to managers as raising debt from investors.

**B. Uninformed Investors**

The most interesting addition to the standard modeling assumptions above is the potential for investors to not know and thus estimate with error or miss perceive the probability of success and failure. We assume all managers (including strategic acquirers) and private equity investors know $p_H$ and $p_L$. However, uninformed investors do not know the true probabilities and instead use the probabilities $p'_H$ and $p'_L$ in assessing expected values.

A difference between the probabilities used by managers and those used by investors could arise fully rationally due to asymmetric information à la Myers and Majluf (1984) (see also Rhodes-Kropf and Viswanathan (2004)).\(^9\) Or, any biases, irrationality, or limited cognitive ability and limits to arbitrage could also result in an equilibrium miss perception in the probability of success (similar to Shleifer and Vishny (2003)). In this paper we take no stand on the source of the mistake only that it is possible for investors to be mistaken. Given the state of the financial markets over the last few years we do not think it is difficult to believe in the possibility that investors misunderstood the potential risk.

The project probabilities can be thought of as having two parts: a firm specific part and a part that relates to the industry/economy as a whole. We focus on a situation in which investors miss perceive the industry/economy-wide component as this alters the opportunity cost for everyone and makes it so that actions by the informed are not revealing and makes arbitrage more challenging and thus the limits to arbitrage argument more plausible.

We assume that uninformed investors still require a return $\gamma$ and have probability beliefs such that only the good projects are economically viable, i.e.,

$$p'_H R^i - \gamma I > 0 > p'_L R^i - \gamma I + B, \forall i \in \{\emptyset, pe, s\}$$

(2)

If debt markets can be under or overvalued then the obvious conclusion is that everyone should issue more debt when it is overvalued by investors and less when investors have too high expectations of default. However, what is interesting about our setup is that it allows us to explore how the

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\(^8\) $\gamma$ could include a return due to the supply and demand for capital as well as for the equilibrium amount of expected agency costs in the model.

\(^9\) If the investor misvaluation is rational then we must assume that prices are not fully revealing. That is, $p'_H$ and $p'_L$ are the probabilities conditional on all available information including the actions of the participants in the know. It seems reasonable that when an acquisition closes the buyer knows more about the true prospects and the potential market mistakes than the lenders so the price paid does not completely reveal the lenders mistakes. In this paper we will calculate the buyers maximum willingness to pay and show the conditions that make one type of buyer willing to pay more, but we do not model the exact game such that payments do not fully reveal.
misvaluation of debt differentially affects the different types of buyers and the stand-alone firm. It would seem that when debt is misvalued all types of buyers and the stand-alone firm could take advantage of it equally, but we will see that this is not the case. Instead valuation bubbles in the debt market can lead to overall increases in acquisition activity but also to waves of dominance of one type of buyer over another.

II. Organizational Forms

This section will first determine the reservation price of the stand-alone firm. If either the PE firm or the strategic buyer offer less than this amount then shareholders can expect a larger expected payout if they refuse the offer. Subsequently, subsections B and C will determine the highest amount the PE firm and the strategic buyer would be willing to offer. With these benchmarks established the following section will examine the drivers that give each type of organizational form a higher willingness-to-pay and thus an advantage in the takeover market.

A. Stand-Alone Firm

We start by examining the reservation price of a stand-alone firm, we denote this amount $V$. Because of the moral hazard problem, it is potentially constrained by the manager’s ability to raise financing from investors as well as the manager’s skill. We will see how this is altered by the uninformed investors’ potential misvaluation of debt.

The reservation price is the same as the amount that the project is worth to the current investors. Investors that do not sell have effectively invested this amount in the project and must earn a return on $V$. Thinking of $V$ as an investment will help facilitate comparison to later sections where the buyer must pay the purchase price upfront as they are not endowed with the project. We will then determine the value of this ‘investment’ to determine the reservation price.

Given the setup described in the previous section, one optimal contract requires the manager to invest $A_M$, and the uninformed investors to invest the balance of $V + I - A_m$.\(^\text{10}\) The contract then pays everyone nothing if the project fails and divides the payoff $R$ into $R_m > 0$ for the manager and $R_u > 0$ for the uninformed investor if the project succeeds, where\(^\text{11}\)

$$R_m + R_u = R. \quad (3)$$

\(^\text{10}\)Thinking of the opportunity cost of not selling from the investors or the manager’s point of view is equivalent because if the investor owned the project they could sell part of the project for $V + I - A_m$.

\(^\text{11}\)Since both the manager and the investors get a fixed payoff this could be thought of as inside and outside equity or debt. The notion that our results relate to debt becomes more clear later when projects are combined and the investors get a priority payout if either project succeeds.
First, the manager will only choose the good project if \( p_H R_m \geq p_L R_m + B \), therefore

\[
Manager \ (IC) \quad R_m \geq B/\Delta p. \tag{4}
\]

This is the true incentive compatibility (IC) constraint for the manager. On the other hand and given equation (1) uninformed investors will only invest if they believe the manager will choose the better project. However, uninformed investors have a different view of the manager’s IC constraint. Given the investors’ probability beliefs they think that the following equation is the manager’s IC constraint and thus it is only rational for investors to provide debt for the project as long as

\[
R_m \geq B/\Delta p'. \tag{5}
\]

The notion that there is both a true IC constraint and a different perceived IC constraint is a novel addition to the model. Only if the perceived IC constraint holds will uninformed investors invest \( V + I - A_m \) (as long as they expect to earn \( \gamma \) on this investment). Thus, individual rationality on the investor’s side requires \( p'_H R_u \geq \gamma(\bar{V} + I - A_m) \). As is immediate to see, if uninformed investors have overestimated the strength of the good project they require too low a return \( R_u \) and vice versa.

Using equation (3) we can express the manager’s payoff if the project is successful as

\[
R_m = R - \gamma(\bar{V} + I - A_m)/p'_H. \tag{6}
\]

This expression allows us to rewrite (5) as follows,

\[
Investor's \ view \ of \ (IC) \quad R_m = R - \gamma(\bar{V} + I - A_m)/p'_H \geq B/\Delta p'. \tag{7}
\]

Finally, the manager’s expected return must also be greater than \( \gamma A_m \) otherwise the manager would rather invest \( A_m \) elsewhere. We assume an inelastic supply of projects that earn \( \gamma \). Therefore, the manager’s individual rationality constraint is

\[
Manager \ (IR) \quad \begin{cases} 
R_m \geq \gamma A_m/p_H \text{ if Manager IC holds} \\
R_m \geq (\gamma A_m - B)/p_L \text{ if Manager IC does not hold}
\end{cases} \tag{8}
\]

This is different from a standard model without misvaluation because in a standard model the Manager’s IC always holds in equilibrium. However, with misvaluation it is possible that investors believe that the Manager’s IC holds and believe that the manager will choose the right project even when he will not. In an equilibrium with misvaluation investors may invest and find that the manager chooses to shirk. Thus, the Manager’s IR must ensure that the manager’s decision to participate is rational.
even when his IC does not hold.

Having derived all the relevant constraints of the model, we start by showing a preliminary result that simplifies the optimization program and will help us derive the reservation value $\bar{V}$ of the project.

**Lemma 1** The reservation price of the project, $\bar{V}$, is the largest $V$ such that the following constraint still holds:

$$
R - \gamma (V + I - A_m)/p'_H \geq \max \{B/\Delta p', \min[\gamma A_m/p_H, (\gamma A_m - B)/p_L]\}
$$

**Proof.** The shareholders of the project expect to get $p'_H R_u = \gamma (V + I - A_m)$. Thus, they effectively earn a return on the amount they invest, $I - A_m$, and on the opportunity cost of not selling for $V$. The investor’s ability to extract value is constrained by the IC and IR constraints of the manager. Thus, the $\bar{V}$ is the largest number such that the manager’s payoff satisfies the perceived IC constraint, $B/\Delta p'$ and the relevant IR, which is the minimum of $\gamma A_m/p_H$ and $(\gamma A_m - B)/p_L$. To understand the use of the min function it is easy to check that if $\gamma A_m/p_H < (\gamma A_m - B)/p_L$ then $\gamma A_m/p_H > B/\Delta p$ and hence $(\gamma A_m - B)/p_L > B/\Delta p$. Therefore, if $R_m > B/\Delta p$ then the IC holds and what matters is max {$B/\Delta p', \gamma A_m/p_H$}. If, on the other hand, $\gamma A_m/p_H > (\gamma A_m - B)/p_L$ then $(\gamma A_m - B)/p_L < B/\Delta p$ and $\gamma A_m/p_H < B/\Delta p$. Therefore, if $R_m < B/\Delta p$ then the IC does not hold and what matters is max {$B/\Delta p', (\gamma A_m - B)/p_L$}. Thus the min function ensures the right IR is holding.

The result above will help determine the reservation price of the current manager. It shows that the current manager of the project could only ever extract value from it to the point where investors think the manager will no longer choose high effort or until the manager will no longer participate. We are interested in establishing clear benchmarks about the willingness-to-pay of each type of organizational form in order to understand when one type of buyer is willing to pay more. The stand-alone manager’s reservation price is the same as their willingness-to-pay. With benchmarks on willingness-to-pay we can determine factors that make deals more or less likely, as we will show in the next section, assuming that a higher willingness-to-pay translates into a higher probability of a deal.

Next we use lemma 1 to derive the minimum value that any potential target would accept. This is the stand-alone value of the firm.
Proposition 1 The reservation value of the stand-alone firm, \( \bar{V} \), is defined by

\[
\bar{V} = \frac{p'_H}{\gamma} (R - \frac{B}{\Delta p'}) - I + A_m \tag{10}
\]

if \( B/\Delta p' \geq \min[\gamma A_m/p_H, (\gamma A_m - B)/p_L] \)

\[
\bar{V} = \frac{p'_H}{\gamma} R - I + (1 - \frac{p'_H}{p_H})A_m \tag{11}
\]

if \( (\gamma A_m - B)/p_L \geq \gamma A_m/p_H > B/\Delta p' \)

\[
\bar{V} = \frac{p'_H}{\gamma} (R + \frac{B}{p_L}) - I + (1 - \frac{p'_H}{p_L})A_m \tag{12}
\]

if \( \gamma A_m/p_H > (\gamma A_m - B)/p_L > B/\Delta p' \)

\[
\frac{\partial \bar{V}}{\partial p'_H} > 0
\]

\[
\text{Proof. See Appendix.} \]

The reservation value is defined by which manager constraint binds; his perceived IC or his IR. These will provide a reservation price benchmark to which we will compare the willingness-to-pay of the financial and strategic bidders.

Thus, Proposition 1 shows us that the reservation price of a stand-alone firm is altered by the misperception of uninformed investors. That is, overvaluation in the debt market raises the reservation value of the stand-alone firm. Therefore, it is not even obvious that more acquisitions should occur when debt is cheap, let alone what type of buyer (financial or strategic) should dominate. Thus, the effects of debt misvaluation are neither trivial nor obvious and more work is needed.

Examining Proposition 1 we see that if \( \bar{V} \) is defined by either equation (11) or (12) then the reservation price is increasing with over valuation, since the derivative with respect to \( p'_H \) is strictly positive. Interestingly, the larger \( A_m \) is the lower the impact of overvaluation because less must be borrowed. If \( \bar{V} \) is defined by (10) then the effects of misvaluation are potentially ambiguous. If investors overvalue the better project, \( p'_H \) increases, then the reservation price clearly increases but if overvaluation causes the low project to be overvalued then depending on relative overvaluation the moral hazard problem may become worse, thus lowering the reservation value – we will come back to this point later.

It is useful here to pause and consider why there are three different pricing equations in Proposition 1 since we will see three regions for each type of organizational form (for which we will solve in the next subsections). One might have expected the stand-alone value of the firm to simply be the discounted net present value of the investment. This is usually the case absent any misvaluation. If \( p'_H = p_H \) and \( p'_L = p_L \) then it can be shown that the reservation value would be \( \bar{V}^* = p_H R/\gamma - I \), (equation 11) the net present value of the project. Both the first and third subcases in Proposition 1 disappear since they both rely on either the difference between \( B/\Delta p' \) and \( B/\Delta p \) or the presence of shirking in equilibrium, as in equation (12). Thus, it is the mispricing directly and through its interaction...
with the moral hazard problem that leads to the three different equations for the reservation value. The first pricing equation, equation 10 arises because the firm may be constrained by the uniformed investors perception of the IC constraint, i.e., the uninformed investors would not provide any more financing. The third pricing equation, equation 12 arises when the manager shirks in equilibrium. This cannot happen in a standard model but is possible with mispricing.

Proposition 1 demonstrates the reservation value of the stand alone firm. We can also establish the minimum cash the firm must have to even get financing and stay as a stand alone firm. The manager must have a minimum $A_m$ in order to just attempt to get the firm by ‘paying zero’ but getting investors to provide the investment the project needs. The minimum acceptable cash is

$$A_m \geq \overline{A}_m = I - \frac{\nu' H}{\gamma} (R - \frac{B}{\Delta p'}).$$

Equation (13) demonstrates that as investors overestimate the strength of the good project (debt is offered “too cheap”) the minimum required manager investment may fall ($\frac{\partial \overline{A}_m}{\partial \nu' H} < 0$). Therefore, debt overvaluation can actually mitigate the underinvestment problem caused by the moral hazard problem.

We have established the stand alone firm benchmarks and will now do the same for financial and then strategic buyers.

B. Private Equity Buyout

In this section we consider a manager who combines forces with a PE investor as an alternative organizational form to manage the company’s assets. We will denote $\overline{V}^{pe}$ the maximum amount a manager and a PE investor are willing to pay. This amount will differ from the stand-alone reservation value, $\overline{V}$, or the the amount a strategic acquirer (a manager with another project) might pay for several reasons. First, the PE investor can monitor the manager (at a cost, $c$) and eliminate the high private benefit project. Second, the PE firm might boost the firm’s potential return from investing ($R^{pe}$). Third, the buyout specialist invests his own capital $A_{pe}$, in the company. And finally, misvaluation effects PE acquirers differently from stand alone firms. Since we are most interested in the effects of misvaluation we will sometimes assume away the other differences to focus on the misvaluation effects.

Note that the minimal acceptable cash ignores the manager’s IR because the minimum acceptable cash needed to attract investors is always larger than the minimum cash needed to meet the IR. See footnote 13.

The minimum acceptable cash is always a function of $B/\Delta p'$ because if

$$\max[B/\Delta p', \min[\gamma A_m/p_H, (\gamma A_m - B)/p_L]] = \gamma A_m/p_H \text{ or } (\gamma A_m - B)/p_L$$

then $A_m$ could be lower and uninformed investors would still invest. So $A_m$ can drop until $\max[B/\Delta p', \min[\gamma A_m/p_H, (\gamma A_m - B)/p_L]] = B/\Delta p'$. Therefore the minimum $A_m$ is always defined by $R - \gamma(I - A_m)/p_H = B/\Delta p'$. 

12
Following the same reasoning as in the previous section, one optimal contract requires the manager to invest $A_m$, the PE investors to invest $A_{pe}$ and the uninformed investors to invest the balance of $V_{pe} + I - A_m - A_{pe}$. The contract then pays everyone nothing if the project fails and if the project succeeds divides the payoff $R_{pe}$ into $R_{pe}^m > 0$ for the manager, $R_{pe}^u > 0$ for the PE investor and $R_{pe}^u > 0$ for the uninformed investor, where

$$R_{pe}^m + R_{pe}^u + R_{pe}^u = R_{pe}.$$

Given equation (1) uninformed investors will only invest if they believe the manager will choose the good project. Now, however, if the PE firm monitors the manager (at a cost $c \geq 0$) investors need only believe that

$$p'_{H} R_{pe}^m \geq p'_{L} R_{pe}^u + b.$$

Therefore, the incentive-compatible investor belief requires that the manager is paid at least

$$R_{pe}^m \geq b/\Delta p',$$

and the belief that the PE monitors management requires the investors to believe that

$$p'_{H} R_{pe}^u \geq p'_{L} R_{pe}^u + c.$$

Therefore, the incentive-compatible investor belief requires

$$R_{pe}^u \geq c/\Delta p'.$$

If conditions (17) and (19) hold then uninformed investors will invest $V_{pe} + I - A_m - A_{pe}$ as long as they also expect to earn $\gamma$ on this investment. Thus, $p'_{H} R_{u} = \gamma(V_{pe} + I - A_m - A_{pe})$.

Given the required return to investors, the manager and PE investor together earn

$$R_{pe}^m + R_{pe}^u = R_{pe} - \gamma(V_{pe} + I - A_m - A_{pe})/p'_{H},$$

if the project is successful. Given this, the manager will only choose the good project and the PE investors will only monitor if

$$Manager/PE (IC) \quad R_{pe}^m + R_{pe}^u = R_{pe} - \gamma(V_{pe} + I - A_m - A_{pe})/p'_{H} \geq (b + c)/\Delta p.$$

This is the true IC constraint for the manager and PE investor combined. We can treat the manager and PE investor as one unit because they are both informed and share surplus. Thus, either the
manager will choose the good project and the PE investor will monitor or both will shirk. If there is enough surplus between them that they are better off not shirking then we assume they will divide the surplus in a way that ensures that they both do so and if not they will not. Specifically, we assume that $R_{pe}^m < B/\Delta p$ otherwise the manager behaves without monitoring and they do not function as a unit.

In summary, investors will only provide funding for the project if they believe the manager will choose the good project and the PE investor will monitor. However, once again uninformed investors potentially have an incorrect view. The investors view of the joint IC constraint is

$$
\text{Investor's view of (IC)} \quad R_{pe}^m + R_{pe}^p = R_{pe}^m - \gamma(\overline{V}_{pe} + I - A_m - A_{pe})/p_H \geq (b + c)/\Delta p',
$$

(22)

The manager’s expected return must also be greater than $\gamma A_m$ otherwise the manager would rather invest $A_m$ elsewhere and the PE investor’s expected return must be great than $\gamma_{pe} A_{pe}$. We assume that PE capital is potentially scarce so PE investors require a return of $\gamma_{pe} \geq \gamma$. Therefore, the manager’s and PE investor’s joint individual rationality constraint is

$$
\text{Manager/PE (IR)} \begin{cases} 
R_{pe}^m + R_{pe}^p \geq (\gamma A_m + \gamma_{pe} A_{pe})/p_H & \text{if Manager/PE IC holds} \\
R_{pe}^m + R_{pe}^p \geq (\gamma A_m + \gamma_{pe} A_{pe} - B)/p_L & \text{if Manager/PE IC does not hold}
\end{cases}
$$

(23)

Using Lemma 1, we find that the PE team is willing to pay an amount $\overline{V}_{pe}$ which is defined by the following constraint

$$
R_{pe}^m - \gamma(\overline{V}_{pe} + I - A_m - A_{pe})/p_H \geq \max \left\{ (b + c)/\Delta p', \min \left[ \frac{(\gamma A_m + \gamma_{pe} A_{pe})}{p_H}, \frac{(\gamma A_m + \gamma_{pe} A_{pe} - B)}{p_L} \right] \right\}
$$

(24)

In words, the PE/Manager combination is willing to raise its offer until either the perceived IC or an IR binds.

To complete the determination of the PE firm’s maximum willingness to bid we need to determine the amount of PE capital, $A_{pe}$. If the Manager/PE IC holds then the PE investor is willing to alter his capital in order to raise the price until the point where $\gamma_{pe} A_{pe} = p_H c/\Delta p$. If the Manager/PE IC does not hold the PE investor is only able to alter his capital in order to raise the price until the point where investors still perceive that he will monitor, i.e. $\gamma_{pe} A_{pe} = c/\Delta p'$. Using these two expressions for $A_{pe}$ when the IC does and does not hold we can solve for $\overline{V}_{pe}$ for three possible cases.

---

Footnote 14: Note that B is not replaced by b in the second inequality below or in equation (24) because that part of the equation is relevant only when the PE IC does not hold so no one will monitor.
of the model’s parameter values. This result is contained in the following proposition.

**Proposition 2** The highest willingness to pay by a PE firm is given by

\[
\begin{align*}
\bar{V}^{pe} & = \frac{p_H}{\gamma} (R^{pe} - \frac{b + c}{\Delta p'}) - I + A_m + \frac{p_H c}{\gamma_{pe} \Delta p} \\
& \text{if } (b + c)/\Delta p' \geq \min\left[ (\gamma A_m + \gamma_{pe} A_{pe})/p_H, (\gamma A_m + \gamma_{pe} A_{pe} - B)/p_L \right] \tag{25} \\
\bar{V}^{pe} & = \frac{p_H}{\gamma} R^{pe} - I + (1 - \frac{p_H}{p_H}) A_m + \left( \frac{p_H}{\gamma_{pe}} - \frac{p_H}{\gamma} \right) \frac{c}{\Delta p} \\
& \text{if } (\gamma A_m + \gamma_{pe} A_{pe} - B)/p_L \geq (\gamma A_m + \gamma_{pe} A_{pe})/p_H > (b + c)/\Delta p' \tag{26} \\
\bar{V}^{pe} & = \frac{p_H}{\gamma} (R^{pe} + \frac{B}{p_L}) - I + (1 - \frac{p_H}{p_L}) A_m + \left( \frac{1}{\gamma_{pe}} - \frac{1}{\gamma} \right) \frac{p_H c}{\gamma_{pe} \Delta p'} \\
& \text{if } (\gamma A_m + \gamma_{pe} A_{pe})/p_H > (\gamma A_m + \gamma_{pe} A_{pe} - B)/p_L > (b + c)/\Delta p' \tag{27}
\end{align*}
\]

**Proof.** See Appendix. ■

If \(\bar{V}^{pe}\) is defined by either equation (26) or (27) then the PE firm’s willingness-to-pay is increasing with overvaluation, \(p’_H\). Interestingly, the larger \(A_m\), or \(c\), is the lower the impact of overvaluation because less must be borrowed (a larger \(c\) increases the cash the PE firm must bring to the table). If \(\bar{V}^{pe}\) is defined by (25) then the effects of misvaluation are potentially ambiguous. If investors overvalue the better project, \(p’_H\) increases, then the willingness to pay clearly increases but if overvaluation causes the low project to be more overvalued then depending on relative overvaluation the moral hazard problem may become worse, thus lowering the willingness to pay.

Since a target would only be willing to accept positive offers the manager must have a minimum \(A_m\) in order to be able to access financing from uniformed investors. The minimum acceptable cash is

\[
A_m \geq A_m^{PE} = I - \frac{p_H}{\gamma} (R^{pe} - \frac{b + c}{\Delta p'}) - \frac{p_H c}{\gamma_{pe} \Delta p} \tag{28}
\]

The equation again demonstrates, as in the case of stand-alone firms, that as investors overestimate the strength of the good project (debt is offered “too cheap” in equilibrium) the minimum required manager investment rises. However, if overvaluation affects \(p_L\) the overall affect is ambiguous since \(\Delta p'\) can either increase or decrease (i.e., the perceived moral hazard problem can get either worse or better).

Thus, we have established the minimum cash needed and the highest willingness-to-pay of a financial buyer. But it is not yet clear how misvaluation will effect the firm. After we establish the benchmark for strategic buyers we will come back to this issue.

15
C. Strategic Acquisition

In this section we consider a manager who already has a project and is trying to buy a second project. We will call this manager a strategic acquirer and assume she has access to cash in the amount of twice $A_m$ to allow proper comparison with alternative organizational forms.\textsuperscript{15}

A manager with two projects still might enjoy private benefits but she now has the potential to get twice as many private benefits if she makes the low quality (high private benefit) choice for both projects. Each project still requires an investment of $I$ and each project generates a return $R^s$ with the same real and perceived probabilities as above. $R^s$ may differ from $R^pe$ and $R$ because a manager with a second project might be able to generate operating synergies (potentially negative). The payoffs of all claims are based on the outcome of both projects. Thus, we are ruling out project financing as this would be the same as a manager with a single project, which we have already analyzed.\textsuperscript{16}

With two projects, one optimal contract requires the manager to invest $2A_m$, and the uninformed investors to invest the balance of $2(\bar{V}^s + I - A_m)$. The contract then pays everyone nothing if both projects fail, pays the manager nothing if one project fails, and if both projects succeed divides the payoff $2R^s$ into $R^s_m > 0$ for the manager and $R^s_u > 0$ for the uninformed investor, where

$$R^s_m + R^s_u = 2R^s. \quad (29)$$

Given equation (1) uninformed investors will only invest if they believe the manager will choose the good projects. Now, however, the manager only gets paid if both projects pay off thus investors need only believe that

$$p_H^2 R^s_m \geq p_L^2 R^s_m + 2B \quad (30)$$

Therefore, the incentive compatible investor belief requires that the manager is paid at least

$$\text{Investor's view of } (IC) \quad R^s_m \geq 2B/(p_H^2 - p_L^2) \quad (31)$$

However, since $p_H^2 - p_L^2 \neq p_H^2 - p_L^2$ the manager will not actually choose the good project unless $R^s_m \geq 2B/(p_H^2 - p_L^2)$ - we must account for this when we consider the manager’s individual rationality constraint.\textsuperscript{17}

If condition (31) holds then uninformed investors will invest $2(\bar{V}^s + I - A_m)$ if they expect to earn $\gamma$ on this investment. Thus,

$$p_H^2 R^s_u + 2p_H(1 - p_H)R^s = 2\gamma(\bar{V}^s + I - A_m). \quad (32)$$

\textsuperscript{15}This can be thought of as two managers coming together to combine projects and jointly financing them.

\textsuperscript{16}This is equivalent to assuming that the returns from each project cannot be verifiably attached to that project.

\textsuperscript{17}For example, with the assumption that $p_j^s = p_j + \delta$ then $p_H^2 - p_L^2 = (p_H^2 - p_L^2) + \delta(p_H - p_L)$.
Note that in the equation above we use the fact that in case only one of the projects is successful the payoff to the investor is the entire cash flow available, \( R^s \), thus investors retain a debt like priority. Hence the only unknown variable is \( R^s \).  

Given the required return to investors, the manager earns

\[
R^s_m = 2R^s - R^u
= 2R^s - \frac{2\gamma(V^s + I - A_m) - 2p'_H(1 - p'_H)R^s}{p^2_H}
\]  

(33)

if both projects are successful and thus will only choose the better projects if

\[
\text{Manager (IC)} \quad R^s_m = 2R^s - 2\gamma(V^s + I - A_m)/p^2_H + 2(1 - p'_H)R^s/p'_H \geq 2B/(p^2_H - p^2_L).
\]  

(34)

And investors will only provide debt for the project if they believe the manager will choose the good projects.

The manager’s expected return must also be greater than \( 2\gamma A_m \) otherwise the manager would rather invest \( A_m \) elsewhere. As before, we assume an inelastic supply of projects that earn \( \gamma \). Therefore, the manager’s individual rationality constraint is

\[
\text{Manager (IR)} \quad \begin{cases} 
R_m \geq 2\gamma A_m/p^2_H & \text{if Manager IC holds} \\
R_m \geq 2(\gamma A_m - B)/p^2_L & \text{if Manager IC does not hold}
\end{cases}
\]  

(35)

Thus, using lemma 1 the manager raises \( V^s \) as high as possible subject to the following constraint:  

\[
2R^s/p'_H - 2\gamma(V^s + I - A_m)/p^2_H \geq \max \{ 2B/(p^2_H - p^2_L), \min[2\gamma A_m/p^2_H, 2(\gamma A_m - B)/p^2_L] \}.
\]  

(36)

In words, the strategic is willing to pay more up to the point where the manager no longer chooses high effort even though uninformed investors think that she will, but then her IR changes to include her private benefits and the lower probability of success. Which IR is relevant depends on whether or not the IC holds at the highest price the manager is willing to pay.

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18Section IV.F. explores the situation when this is not the case and shows that the main result still holds.

19To understand the use of the min function in this case note that if \( \gamma A_m/p^2_H < (\gamma A_m - B)/p^2_L \) then \( \gamma A_m/p^2_H > B/(p^2_H - p^2_L) \) and hence \( (\gamma A_m - B)/p^2_L > B/(p^2_H - p^2_L) \). Therefore, if \( R_m > B/(p^2_H - p^2_L) \) (IC holds) what matters is \( \max \{ B/(p^2_H - p^2_L), \gamma A_m/p^2_H \} \). If \( \gamma A_m/p^2_H > (\gamma A_m - B)/p^2_L \) then \( (\gamma A_m - B)/p^2_L < B/(p^2_H - p^2_L) \) and \( \gamma A_m/p^2_H < B/(p^2_H - p^2_L) \). Therefore, if \( R_m < B/(p^2_H - p^2_L) \) (IC does not hold) and what matters is \( \max \{ B/(p^2_H - p^2_L), (\gamma A_m - B)/p^2_L \} \). Thus the min function ensures the right IR is holding.
Proposition 3 The highest $V^s$ a strategic acquirer is willing to pay is defined by

$$V^s = \frac{p_H'}{\gamma} (R - \frac{p_H' B}{p_H' - p_L'}) - I + A_m$$

if $B/(p_H'^2 - p_L'^2) \geq \min[\gamma A_m/p_H', (\gamma A_m - B)/p_L'^2]$

$$V^s = \frac{p_H'}{\gamma} R - I + (1 - \frac{p_H'^2}{p_H'}) A_m$$

if $(\gamma A_m - B)/p_L'^2 \geq \gamma A_m/p_H'^2 > B/(p_H'^2 - p_L'^2)$

$$V^s = \frac{p_H'}{\gamma} (R + \frac{p_H' B}{p_L'}) - I + (1 - \frac{p_H'^2}{p_L'}) A_m$$

if $(\gamma A_m - B)/p_L'^2 > (\gamma A_m - B)/p_H'^2 > B/(p_H'^2 - p_L'^2)$

Proof. See Appendix.

If $V^s$ is defined by either equation (38) or (39) then the strategic firm’s willingness-to-pay is increasing with over valuation, $p_H'$. Furthermore, the larger $A_m$ is the lower the impact of overvaluation because less must be borrowed. If $V^s$ is defined by (37) then the effects of misvaluation are potentially ambiguous. If investors overvalue the better project, $p_H'$ increases, then the willingness to pay clearly increases but if overvaluation causes the low project to be more overvalued then depending on relative overvaluation the moral hazard problem may become worse, thus lowering the willingness to pay.

Following the same procedure as before it is easy to show that for a strategic acquisition the minimum $A_m$ is defined by

$$A_m \geq \tilde{A}_m = I - \frac{p_H'}{\gamma} \left( R - \frac{p_H' B}{p_H' - p_L'} \right).$$

This completes the characterization of a strategic acquisition where two projects are organized under the same firm. Having examined the three possible organizational forms we next compare them and derive the main results of the paper.

III. Comparing Different Organizational Forms

We split this section into two parts. The first analyzes, in isolation, the insurance effect that arises from combining the asymmetry of information (misvaluation) with the diversification of cash flows in debt contracts. That is, it shows that the difference in information between debtholders and managers creates a gap in the willingness to pay of strategic buyers compared to financial buyers that has to do with the diversification of cash flows. In the second part of this section we analyze the additional insights that come from the moral hazard aspect of our baseline model and in particular from the interaction with the misvaluation caused by asymmetric information.
A. The Insurance/Price Effect

In order to highlight the effect that results from diversification in markets with asymmetric information we first abstract away from the moral hazard part of our set-up. We do so without loss of generality in the sense that this effect does not depend on the extent or existence of moral hazard between investors and management, we choose to isolate it only for expositional reasons. In this subsection we assume that \( B = 0 \). Since \( B \geq b \) this implies that \( b = 0 \) and that \( A_{pe} = 0 \) since there is no role for monitoring in equilibrium. The following proposition contains an important result of this paper.

**Proposition 4** Everything else equal, financial buyers are able to pay more (less) than strategic buyers when debt is overvalued (undervalued). Furthermore, in this case, they leverage more than strategic acquirers.

**Proof.** First, in order to make everything else equal we set \( B = 0 \), as argued above. This implies \( b = 0 \) as well. Second, using the results in proposition 2 and 3, it is easy to see that the relevant equations become (26) and (38) since \( A_m/p_L^2 \geq A_m/p_H^2 > 0 \). The difference between \( \bar{V}_{pe} \) and \( \bar{V}_{s} \) is, after some algebra,

\[
\frac{p'_H}{\gamma} (R_{pe} - R^s) + \left( \frac{p'_H}{p_H} \right)^2 - \left( \frac{p'_H}{p_H} \right) A_m + A_{pe}.
\]

Because \( B = b = 0 \), \( A_{pe} = 0 \) in equilibrium, since there is no monitoring role for PE firms. Finally we must set \( R_{pe} = R^s \), so that there is no fundamental difference between strategic and financial buyers in terms of productivity enhancement. The above difference becomes simply

\[
\left( \frac{p'_H}{p_H} \right)^2 - \frac{p'_H}{p_H} A_m.
\]

The term is positive if and only if \( p'_H > p_H \), that is, when debt is overvalued. Finally, the proof of the last claim is immediate since leverage is the dollar amount of funds coming from uninformed investors, that is, \( \bar{V}_{pe} + I - A_m - A_{pe} \) in the case of a financial buyer and \( \bar{V}' + I - A_m \) in the case of a strategic buyer. By subtracting both amounts we find that the leverage difference is precisely

\[
\left( \frac{p'_H}{p_H} \right)^2 - \frac{p'_H}{p_H} A_m \text{ which, as just shown, is positive when debt is overvalued.} \]

This proposition shows us that one effect of misvaluation always helps financial buyers to outbid strategic buyers, moreover, the more overvaluation there is the larger the benefit to financial buyers. This does not mean that financial buyers will always beat strategics. In general, there are other effects that will also influence who is willing to pay more. Equation (41) above shows us the limits to the advantage of financial buyers. First, to the extent that a strategic acquisition is able to realize significant synergies, the expression above becomes less likely to hold, as we would expect. Any financial buyer should be challenged by an acquirer that is able to create synergistic value. Second, to
the extent that the PE firm brings its own capital, the amount borrowed from uninformed investors is reduced. This then limits the positive effect coming from overvaluation since less is borrowed from uninformed investors. This prediction, although not obvious, is also economically intuitive.

Overall this important result tells us that overvalued debt tends to help financial buyers more than strategic buyers. Thus, the ratio of deals completed by financial buyers relative to strategic buyers should tend to increase during overvalued debt markets.

While the interaction effect of diversification and asymmetric information on the willingness to pay of financial and strategic buyers (price/insurance effect) is of first order, the more general setting with moral hazard also has interesting implications regarding the presence and ratio of financial to strategic buyers. We discuss this next.

B. The General Model with Moral Hazard

We noted in the model setup that the asymmetry of information between debtholders and managers has implications that come from an interaction with the hidden-action agency problem. This problem creates an ex-ante financing constraint and establishes a minimum amount of internal funds \( A_m \) such that financing will be available, as shown in section I. This cutoff determines whether a particular firm will be able to sell a debt instrument in order to finance the investment in the context of an acquisition. A changing cutoff, therefore, will increase or decrease the number of potential PE or strategic buyers and further explain the shifting type of acquirer (financial and/or strategic).

In this section we examine, among other things, when overvaluation allows more companies to raise financing under the sponsorship of a PE firm versus a strategic deal. This effect, which we sometimes refer as quantity effect, should be added to the insurance/price effect discussed in the previous section in order to have a complete picture of the determinants of merger activity.

Moreover, the results related to comparing the different values of \( \overline{A} \) have also important implications for prices.\(^\text{20}\) At the end of this section, we show a general result on prices that combines these results with those of the previous section.

We start by adding some additional structure to our existing model. In particular we will think of \( p'_H \) and \( p'_L \) not just as parameters but functions of an underlying variable that measures the extent of asymmetric information or misvaluation, \( \mu \). That is, with a slight abuse of notation let us define \( p'_H \equiv p'_H(\mu) \) and \( p'_L \equiv p'_L(\mu) \), where \( p' \) is a continuous, differentiable and strictly increasing function of \( \mu \) over its domain: \((-\infty, +\infty)\) and is bounded between 0 and 1. Moreover we shall note that \( p'_H(0) = p_H \) and \( p'_L(0) = p_L \); namely, in the absence of misvaluation (\( \mu = 0 \)) the perceived probability \( p' \) coincides with the true probability, \( p \), and \( \mu > 0 \) results in overvaluation while \( \mu < 0 \) results

\(^{20}\)The reason being that that the definition of \( \overline{A} \) is generated using (10), (25) and (37).
in undervaluation. Let us also establish the following relationship between the relative impact of misvaluation in the probability of success of the better project versus the worse:

**Condition 1** \( \frac{\partial p'_H}{\partial \mu} / p'_H < \frac{\partial p'_L}{\partial \mu} / p'_L. \)

In words the condition above states that the misperception elasticity of the investor-perceived probability function is lower for a sound project (high probability of success/high effort) than for the project that generates more private benefits but lower probability of success. This condition suggests the notion that those investments that generate more private benefits to management are also more prone to being misperceived or estimated with more error by investors. Although we think that this is plausible it is ultimately up to the data to show whether it describes reality well. Going forward we do not assume this condition holds, but rather we establish results that depend on whether or not it does.

We start by comparing \( \bar{A}_m \) and \( \bar{A}^{pe}_m \). We do so because such comparison will throw light on the determinants of aggregate buyout activity in general. If and when \( \bar{A}^{pe}_m < \bar{A}_m \) all firms with \( A_m \in [\bar{A}^{pe}_m, \bar{A}_m) \) would only obtain financing in a PE deal, making a leverage buyout the only possible organizational form. Moreover, because such mass of firms possess the smallest amount of internal funds, they would also be the most leveraged deals in the economy since the amount borrowed from uninformed investors would be the largest, other things equal. This is precisely a key feature of PE buyouts that our model helps explain. The following result establishes this comparison.

**Proposition 5** Define \( \Delta R^{pe} \equiv R^{pe} - R \). If \( \Delta R^{pe} \geq 0 \), a sufficient condition for \( \bar{A}^{pe}_m < \bar{A}_m \) is efficient monitoring, \( B - (b + c) > 0 \). The difference \( \bar{A}^{pe}_m - \bar{A}_m \) becomes more negative with increases in \( R^{pe} \) and \( B \) and less negative with increases in \( R \) and \( b \). The effect of \( c \) is ambiguous. Moreover, if condition 1 holds, overvaluation (undervaluation) makes this inequality more (less) likely to hold, that is,

\[
\frac{\partial (\bar{A}^{pe}_m - \bar{A}_m)}{\partial \mu} < 0.
\]

**Proof.** See Appendix.

Essentially, the result above states that the larger the monitoring benefits relative to its costs are the more likely that a PE deal provides more access to financing and hence unlocks value compared to the stand-alone scenario, as one would expect. This is the case whenever \( B > b + c \). This condition is however only sufficient since there are two other effects that can explain \( \bar{A}^{pe}_m < \bar{A}_m \). One, the extent of \( \Delta R^{pe} \geq 0 \), namely if PE firms are able to increase productivity they will increase the chance to obtain outside financing, everything else equal. Two, a PE firm provides additional equity \( (A_{pe}) \), which alleviates the financial constraint as well.

\(^{21}\)Moreover since \( p' < 1 \), we also require that \( \lim_{\mu \to \infty} p'(\mu) = 1 \).
Apart from these fundamental drivers perhaps a more relevant question in the context of this paper is how does asymmetric information affect the firm’s financial constraint by way of either reinforcing or alleviating the moral hazard cost. In general this effect is ambiguous. Overvaluation lowers the expected perceived agency cost since \( p_H' \) affects the term \( p_H' B / \Delta p' \) negatively. However it increases such cost by raising \( p_L' \). So when it comes to comparing a stand-alone firm and a PE buyout, given that the PE firm lowers agency costs \( B > b + c \) we need a low productivity project to react more to asymmetric information in the credit market. Thus, if overvaluation makes things “worse” in terms of the moral hazard problem, then, intuitively, overvaluation will benefit financial buyers given their ability to lower ex-post agency costs.

Thus, what we have shown here is if overvaluation makes the moral hazard problem “worse” and PE are efficient monitors then overvaluation increases the “quantity” of PE acquirers relative to stand alone firms. Thus, under these conditions overvalued debt markets should result in more financial acquisitions in the data.

The next lemma considers how strategic acquirers are affected relative to stand-alone firms with respect to the amount of internal funds required by credit markets. As argued before, since with two projects the alignment of management incentives improves, the next result appears very intuitive.

**Lemma 2** Let us define \( \Delta R^s \equiv R^s - R \). If \( \Delta R^s \geq 0 \), a strategic acquisition always reduces the underinvestment problem coming from moral hazard, that is, \( \overline{A}_m^s < \overline{A}_m \).

**Proof.** Note that using expressions (13) and (40) \( \overline{A}_m^s < \overline{A}_m \) requires \( p_H' B / (p_H'^2 - p_L'^2) < \Delta R^s + B / \Delta p' \). This expression can be rewritten as \( p_H' B / \Delta p' (p_H' + p_L') < \Delta R^s + B / \Delta p' \) which holds since \( p_H' / (p_H' + p_L') < 1 \) and \( \Delta R^s \geq 0 \).

Finally, the most relevant comparison is that of \( \overline{A}_m^s \) with \( \overline{A}_m^{pe} \). This will establish when and why one organizational form is more likely to show up in a potential auction for the target. We start with a preliminary result that provides an expression for the difference between the minimum required internal funds.

**Lemma 3** \( \overline{A}_m^{pe} < \overline{A}_m^s \) if

\[
\frac{p_H'}{p_H' + p_L'} B - (b + c) > \Delta p' \left( R^s - R^{pe} - \frac{\gamma p_H p_H'}{\gamma p_H p_H' \Delta p} c \right)
\]

**Proof.** Direct by substitution, using (28) and (40).

The lemma implies that when (42) holds, \( \overline{A}_m^{pe} < \overline{A}_m \) since we have shown that \( \overline{A}_m^s < \overline{A}_m \). Building on this result, if condition (42) holds, there is a mass of firms with \( A_m \in (\overline{A}_m^{pe}, \overline{A}_m^s) \) which only financial bidders can buy and hence a PE buyout is the optimal organizational form. If condition (42) does not hold, then for firms with \( A_m \in (\overline{A}_m^s, \overline{A}_m^{pe}) \) strategic buyers become the unique optimal
organization, hence only strategic buyers would bid for firms in that interval. For firms such that
\[ A_m > \max\{A_m^{pe}, A_m^{sm}\} \] both types of buyers are likely to be present in an auction for the company. The condition is economically intuitive. The borrowing constraint is driven by the severity of the agency cost caused by moral hazard. So whether PE firms or strategic buyers alleviate the borrowing constraint to a larger extent depends on which of the two does so more efficiently: the PE firm through monitoring or a strategic buyer by way of offering a more powerful contract to the manager. Efficient monitoring is no longer a sufficient condition.

Thus, this shows that to the extent one believes that a PE monitor is a more efficient form of governance than a conglomerate, overvaluation in the debt market should lead to more financial sponsor activity relative to strategic activity. This lets us understand what we need to believe in order to think that overvalued debt markets increase financial activity relative to strategic activity.

Using the lemma above we next explain why financial buyers are more likely to be the only organizational form possible for the lower end of the distribution of \( A \).

**Proposition 6** If \( R^{pe} - R^s \geq 0 \), a sufficient condition for \( \overline{A}^{pe}_m < \overline{A}^{s}_m \) is \( \frac{p_H'}{p_H + p_L} B - (b + c) > 0 \). The difference \( \overline{A}^{pe}_m - \overline{A}^{s}_m \) becomes more negative with increases in \( R^{pe} \) and \( B \) and less negative with increases in \( R^s \) and \( b \), while the effect of \( c \) is ambiguous. Moreover, if condition 1 holds, overvaluation (undervaluation) makes this inequality more (less) likely to hold, that is,

\[
\frac{\partial \left( \overline{A}^{pe}_m - \overline{A}^{s}_m \right)}{\partial \mu} < 0.
\]

**Proof.** See Appendix.

This proposition tells us, among other things, that if PE firms are better at solving the moral hazard problem than strategic firms, then if overvaluation makes the moral hazard problem worse we should observe more highly leveraged PE transactions in the data. This is because a lower \( \overline{A}^{pe}_m \) means managers with less cash are able to finance a deal with a PE partner.

We now move back from looking at “quantities” and return to considering price effects, i.e., effects on the willingness-to-pay. Since we used (25) and (37) to obtain the definition of \( \overline{A}^{pe}_m \) and \( \overline{A}^{s}_m \), the results above on “quantities” have implications in terms of ranking the overall highest willingness to pay. We can be combine this with the result from the previous section to generate the following (unconditional) ranking of a financial and a strategic’s highest willingness to pay.

**Proposition 7** If \( R^{pe} - R^s \geq 0 \), debt is overvalued \( (p'_H > p_H) \) and \( \frac{p_H'}{p_H + p_L} B - (b + c) > 0 \), the PE firm highest bid dominates the strategic acquirer’s highest willingness to pay.

**Proof.** See Appendix.
This result summarizes all the effects explained in section III. To the extent that strategic synergies are not important then both overvaluation and a stronger form of monitoring efficiency are sufficient to guarantee that the highest willingness-to-pay by a financial buyer lies above that of a strategic buyer. This is not obvious given the functional forms of the pricing equations but it is an intuitive result. If overvaluation makes the moral hazard worse and PE firms are better at countering the moral hazard problem then in general PE firms should be more active acquirers relative to strategic buyers when debt markets are overvalued.

Overall we have shown how debt overvaluation can have an effect both on the acquire willingness-to-pay and on the acquirer ability to finance the deal that could explain why we see increased financial sponsor activity that correlates with high liquidity and low yields in the debt market.

IV. Predictions and Discussions

A. The Merger Wave of 2005-07

The starting point of this paper was the observation that the one thing that seemed to characterize the last wave of acquisition activity of 2005-2007 was the relatively more predominant role of financial buyers. It has been argued by both industry practitioners and some academics that this period was characterized as a period of potentially overvalued debt and hence “too low” yields. This casual observation is consistent with, and predicted by, our model. According to our results a period with overvaluation should have several effects. Provided monitoring is efficient, overvaluation allows relatively more external financing to both financial and strategic buyers, hence more firms are susceptible to being acquired either by a PE group or a strategic acquirer. This speaks about increased acquisition activity. Our central proposition, however, also proves that because of the interaction between misvaluation and cash flow diversification, periods with overvalued debt should cause an increase in the number of financial buyers compared to strategics. Our model provides a characterization of this last merger wave as one potentially caused by, or at least magnified by, the misvaluation of debt (either because of asymmetric information or behavioral factors).

B. The Collapse of the PE Market

Our static setup can also be taken a little further, in a more dynamic thought experiment. Let us assume that debt maturities are shorter than the investment horizon: in this case a PE firm must impound their forecast of future expected misvaluation in debt markets into their willingness to pay today. If debt markets shift from “over” to “undervaluation” it may turn out that a financial buyer paid significantly more than the investment is now worth given that it has to be refinanced with “underpriced” debt. To be clear, this was not a mistake ex-ante but will lead to the possibility of
sudden collapses *ex-post* that are not related to a change in the health of the underlying target. Furthermore, the larger the original debt market mispricing the larger the resulting financial distress situation. Therefore, depending on the costs of financial distress, the underlying target firm may be impacted in a way that would not have occurred had debt markets been correctly priced at all times. This reasoning explains the possibility of financial distress related purely to mispriced debt and not to negative shocks to the firm’s underlying asset value.

C. Divestitures and Asset Sales

Even though we have motivated this paper in the context of acquisition activity, its predictions and implications go beyond asset expansion and can be more generally related to overall restructuring activity. One example of this broader interpretation can be made in the context of optimal asset sale policies. When debt is overvalued a diversified company can potentially unlock value by getting rid of a division. This is so because as a stand-alone entity the division should be better able to extract information rents from lesser informed investors. However, a divestiture will only be optimal strategy provided, of course, that there are no significant synergies between the division to be divested and the rest of the divisions that comprise the original firm. Hence in terms of overvalued debt markets, our paper suggests not only more acquisition activity (with potentially more financial buyers) but also more divestitures or asset sales undertaken by diversified companies or conglomerates. The reason for this prediction is the same driving our acquisition results, namely, the interaction of information asymmetries and diversification of cash flows.

D. Enhancing Diversification: Increasing the Number of Projects

One important dimension in which one might want to check the robustness of our result is by increasing the number of projects beyond two, which was initially assumed for simplicity. Let us assume instead that a strategic buyer consists of $n$ projects if it buys the target. As the following proposition shows, when the number of projects increases the advantage of financial buyers with overvalued debt increases as well. This is because the cost created by diversification in a strategic acquisition becomes greater. The intuition is simple. As $n$ goes to infinity the firm should be so diversified that debt would be riskless: no mispricing should exist at all. This is bad news for a strategic buyer when debt is overvalued and rents can be extracted from investors. At the limit with $n$ approaching infinity, a diversified (strategic) buyer is unable to counterbid any financial or stand-alone buyer.

**Proposition 8** Assume w.l.o.g. that the IC constraint holds, that is, $\forall n \in \mathbb{N}, (\gamma A_m - B)/p^n_L \geq$
The marginal impact of an additional project on a strategic buyer’s willingness to pay is negative, \( \frac{\partial V_{sn}}{\partial n} < 0 \) and larger when debt is overvalued. The proposition also shows that in the limit when the number of projects is arbitrarily large, the highest willingness to pay becomes closer to zero in the case of overvalued debt financing, making the difference between strategics and financial buyers the largest.

E. Correlated Projects

A limiting force on the insurance/misvaluation effect occurs when firm’s cash flows are positively correlated, as opposed to independent. In this case, the price effect shown in Proposition 4 is diminished and financial buyers enjoy a lower advantage, compared to strategics. An extreme example is the case of perfectly correlated projects. If the two projects are perfectly positively correlated, then the possibility of diversification disappears. The strategic acquirer scenario then becomes equal to the stand-alone case. The relevant comparison becomes the stand-alone and the private equity cases, where the differences mainly arise from the different agency costs and there is no interaction between diversification and asymmetric information. We highlight this observation because it has empirical content: we should observe strategic acquirers whose cash flows are more correlated with the target’s being more able to outbid financial buyers.

F. When the Equilibrium Contract is not a Debt Contract

In this subsection we perform another robustness check by looking at an alternative equilibrium contract, one that could arise if \( R^s \) is large enough so that the optimal contract that pays the manager only in the case of success in both projects is not feasible. We refer to the appendix for a full explanation of this scenario, but this alternative contract could arise whenever

\[
2p_H' (1 - p_H') R^s > 2\gamma (\bar{V}^s + I - A_m)。
\]

In this case, the equilibrium contract must be of the form \((R_u^s, R_{ui}^s)\), where the pair denotes
payments to uninformed investors whenever both projects are successful or only one is, respectively (compared to the optimal debt contract where $R_{ui}^s = R^s$ and the manager does not receive any payoff in the intermediate cash flow realizations).

We are interested in analyzing the implications of this alternative contract, which clearly affects the diversification power of the contract that investors sign, by shifting more payoffs to the investors away from the intermediate case (only one project is successful) to the best state (two projects are successful).

Following the same logic behind proposition 4 in trying to isolate the interaction effect between diversification and asymmetric information we assume $B = 0$. When we compare the result in proposition 4 with this alternative contract, the following result arises.

**Proposition 9** If there is overvaluation, the financial acquirer’s willingness to pay with the alternative contract issued to investors, compared to an optimal debt contract, is lower. A financial buyer is able to pay more than a strategic buyer to the extent that

$$\Delta < \left( \left( \frac{\hat{\nu}_H}{\nu_H} \right)^2 - \frac{\nu_H}{\hat{\nu}_H} \right) A_m,$$

where $\Delta \equiv \left( \frac{\hat{\nu}_H^2}{\nu_H^2} - \frac{\nu_H^2}{\hat{\nu}_H^2} \right) R^s + R_{ui}^s \left[ (1 - \frac{\hat{\nu}_H}{\nu_H}) \frac{\nu_H}{\hat{\nu}_H} - \frac{(1 - \frac{\nu_H}{\hat{\nu}_H}) \hat{\nu}_H^2}{\nu_H^2} \right]$.  

*Proof.* See Appendix. ■

This proposition essentially confirms that as the diversification power decreases the relative disadvantage of strategic buyers does so as well. Note that this alternative contract - which is not quite a debt contract - offers less diversification (in the sense that the payoff structure brings more payoffs to the "extreme" case where both projects are successful) hence the disadvantage of a strategic buyer with respect to a financial buyer is reduced by an amount $\Delta$ derived in the appendix. This is similar to the case of correlated projects, explained in the previous section.

**V. Concluding Remarks**

We highlight and then set out to explain the oscillating pattern of financial vs. strategic acquirers within overall merger activity. The wave like increases and decreases in financial sponsor activity relative to strategic activity suggests that a broad economic explanation is driving the shifting dominance of one over the other.

Initially it would seem that current theories of waves of merger activity by Rhodes-Kropf and Viswanathan (2004) and Shleifer and Vishny (2003) would easily explain the shifting dominance of strategic acquirers – when strategic acquires have overvalued stock they dominate financial buyers. However, Figure 1 dispels this notion as a driving force because the relative fraction of financial buyers seems to peak with the stock market. However, logically an overvalued stock market correlates with an overvalued debt market.
We demonstrate that misvaluation in the debt market that can explain increased activity and the relative dominance of financial buyers. This is non-obvious because an overvalued debt market should raise the value of stand alone firms as well as the willingness-to-pay of both financial and strategic acquirers as they can all access cheap debt. We show how misvaluation interacts with both the insurance effect (Lewellen (1971)) of mergers on debt and the moral hazard problem, to give financial firms a relative advantage when debt markets are overvalued.

Strategic acquirers by definition have a current project that they combine with the target project. This has a well known insurance effect on the debt. The magnitude of this insurance effect depends on the independence of the projects that the probability either project has a bad outcome. When debt holders underestimate the probability of the bad outcome they both overvalue the debt and undervalue the insurance effect. At these times strategic acquirers suffer relative to financial buyers. Alternatively, when debt investors overestimate the probability of a bad outcome they both undervalue the debt and overvalue the insurance effect of combining projects. At these times financial acquires on average cannot pay as much as strategic acquirers.

Furthermore, if misvaluation makes the moral hazard problem worse and PE firms are better and counteracting the moral hazard problem, then when debt markets are misvalued PE firms will be able to extract more value from the project than a strategic acquirer, or firms that operate on a stand-alone basis. Thus, misvalued debt markets should lead to more PE activity.

By combining the idea of the insurance effect of strategic M&A with the ideas of misvaluation we gain considerable insights into a previously unexplored pattern. We hope that future work will empirically examine the impact of potentially misvalued debt markets and show its relevance to M&A activity in the same way that so much has followed from the ideas of equity misvaluation.
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**Technical Appendix**

**Proof of Proposition 1 (Highest willingness to pay, stand-alone case).** The proof of this proposition uses the preliminary result contained in Lemma 1. We will show that in fact the maximum willingness to pay can take on three different values depending on the parameter values.

Subcase 1: $B/\Delta p' \geq \min[\gamma A_m/p_H, (\gamma A_m - B)/p_L]$.

In this case the R.H.S. of the constraint in Lemma 1

$$(R - \gamma(\overline{V} + I - A_m))/p_H' \geq \max\{B/\Delta p', \min[\gamma A_m/p_H, (\gamma A_m - B)/p_L]\}$$

becomes $B/\Delta p'$, therefore the maximum willingness to pay is defined by making the constraint $R - \gamma(\overline{V} + I - A_m)/p_H' \geq B/\Delta p'$ bind since the larger $\overline{V}$ is the less likely the constraint will be satisfied. Rearranging terms, we find that

$$\overline{V} = \frac{p_H'}{\gamma}(R - B/\Delta p') - I + A_m.$$

Subcase 2: $(\gamma A_m - B)/p_L \geq \gamma A_m/p_H > B/\Delta p'$.

If the condition above holds then the RHS of the constraint in Lemma 1 becomes $\gamma A_m/p_H$. Therefore the constraint can now be written as $R - \gamma(\overline{V} + I - A_m)/p_H' \geq \gamma A_m/p_H$. The highest willingness to pay is defined by the maximum amount of $\overline{V}$ that still satisfies the constraint, therefore

$$\overline{V} = \frac{p_H'}{\gamma}R - I + (1 - \frac{p_H'}{p_H})A_m.$$

Subcase 3: $\gamma A_m/p_H > (\gamma A_m - B)/p_L > B/\Delta p'$.

In the last subset of parameter values the RHS of the constraint in Lemma 1 is simplified to $(\gamma A_m - B)/p_L$. Following the same logic as in the preceding subcases we find that

$$\overline{V} = \frac{p_H'}{\gamma}(R + \frac{B}{p_L}) - I + (1 - \frac{p_H'}{p_L})A_m.$$

**Derivation of results in the scenario without asymmetric information.**

Absent any information asymmetry between external investors and management only firms with

$$A \geq \overline{A}_m \equiv I - p_H(R - B/\Delta p)/\gamma$$

would receive funding, this is the standard result from Tirole (2005). This implies that $\gamma A_m/p_H > B/\Delta p$ since the NPV of the firm is strictly positive by assumption. Equation (9) can then be rewritten as

$$R - \gamma(\overline{V} + I - A_m)/p_H \geq \gamma A_m/p_H.$$

This is so because now investors coincide with managers in assessing the probability of success and
the right hand side of the equation simplifies to a single case, while the investor’s IR reads $p_H R_u = \gamma(V + I - A_m)$. We can rewrite the constraint as

$$R - \gamma(V^* + I - A_m)/p_H \geq B/\Delta p,$$

which gives us a reservation value of $V^* = p_H R/\gamma - I$, the net present value of the project. ■

Proof of Proposition 2 (Highest willingness to pay, PE case). The proof is parallel to the proof of Proposition 1. It also uses the equivalent of Lemma 1 in the case of a PE firm, that is,

$$R_{pe} - \gamma(V'^{pe} + I - A_m - A_{pe})/p'_H \geq \max\left\{(b + c)/\Delta p', \min[(\gamma A_M + \gamma_{pe} A_{pe})/p_H, (\gamma A_M + \gamma_{pe} A_{pe} - B)/p_L]\right\}.$$ 

We again divide the parameter space in three subcases.

Subcase 1: $(b + c)/\Delta p' \geq \min[(\gamma A_M + \gamma_{pe} A_{pe})/p_H, (\gamma A_M + \gamma_{pe} A_{pe} - B)/p_L]$.

In this case $\max\left\{(b + c)/\Delta p', \min[(\gamma A_M + \gamma_{pe} A_{pe})/p_H, (\gamma A_M + \gamma_{pe} A_{pe} - B)/p_L]\right\} = (b + c)/\Delta p'$.

So the maximum $V'^{pe}$ is defined by

$$R_{pe} - \gamma(V'^{pe} + I - A_m - A_{pe})/p'_H = (b + c)/\Delta p',$$

which gives

$$V'^{pe} = \frac{p'_H}{\gamma}(R_{pe} - (b + c)/\Delta p') - I + A_m + A_{pe}.$$ 

Subcase 2: $(\gamma A_m + \gamma_{pe} A_{pe} - B)/p_L \geq (\gamma A_m + \gamma_{pe} A_{pe})/p_H > (b + c)/\Delta p'$.

In this case it is easy to see that $\max\left\{(b + c)/\Delta p', \min[(\gamma A_M + \gamma_{pe} A_{pe})/p_H, (\gamma A_M + \gamma_{pe} A_{pe} - B)/p_L]\right\} = (\gamma A_m + \gamma_{pe} A_{pe})/p_H$. Therefore following the same logic we arrive at

$$V'^{pe} = \frac{p'_H}{\gamma} R_{pe} - I + (1 - \frac{p'_H}{p_H}) A_m + (1 - \frac{\gamma_{pe} p'_H}{\gamma p_H}) A_{pe}.$$ 

Subcase 3: $(\gamma A_m + \gamma_{pe} A_{pe})/p_H > (\gamma A_m + \gamma_{pe} A_{pe} - B)/p_L > (b + c)/\Delta p'$.

Finally, in this case $\max\left\{(b + c)/\Delta p', \min[(\gamma A_M + \gamma_{pe} A_{pe})/p_H, (\gamma A_M + \gamma_{pe} A_{pe} - B)/p_L]\right\} = (\gamma A_m + \gamma_{pe} A_{pe} - B)/p_L$.

Therefore and by simply rearranging terms, the expression for the highest amount the buyout team is willing to pay is defined by

$$R_{pe} - \gamma(V'^{pe} + I - A_m - A_{pe})/p'_H = (\gamma A_m + \gamma_{pe} A_{pe} - B)/p_L.$$
which, after rearranging, implies

$$\nabla_p = \frac{p_H}{\gamma} (R^p + \frac{B}{p_L}) - I + (1 - \frac{p_H}{p_L})A_m + (1 - \frac{\gamma_p}{\gamma} \frac{p_H}{p_L}) A_{pe}.$$

In order to complete the proof we only need to substitute in the value of the PE capital, $A_{pe}$. As argued in the main text $A_{pe} = p_H e/\gamma_p \Delta p$ it the IC holds and $A_{pe} = p_H e/\gamma_p \Delta p'$ when the IC does not. After substitution it is easy to see that the $\nabla_p$ correspond to those in the proposition.\[ \square\]

**Proof of Proposition 3 (Highest willingness to pay, strategic acquirer).** The proof of this proposition uses the preliminary result contained in Lemma 1 but adapted to the case of a strategic buyer, as explained in equation (36). We will show that in fact the maximum willingness to pay can take on three different values depending on the parameter values.

Subcase 1: $B/(p_H^2 - p_L^2) \geq \min[\gamma A_m/p_H^2, (\gamma A_m - B)/p_L^2]$.

In this case the R.H.S. of the constraint in (36) becomes $B/(p_H^2 - p_L^2)$, therefore the maximum willingness to pay is defined by making that constraint, $R - \gamma (V^* + I - A_m)/p_H^2 \geq B/(p_H^2 - p_L^2)$, bind since the larger $V$ is the less likely the constraint will be satisfied. Rearranging terms, we find that

$$V^* = \frac{p_H}{\gamma} (R - \frac{p_H B}{p_H^2 - p_L^2}) - I + A_m.$$

Subcase 2: $(\gamma A_m - B)/p_L^2 \geq \gamma A_m/p_H^2 > B/(p_H^2 - p_L^2)$.

If the condition above holds then the RHS of equation (36) becomes $\gamma A_m/p_H^2$. Therefore the constraint can now be written as $R - \gamma (V^* + I - A_m)/p_H^2 \geq \gamma A_m/p_H^2$. The highest willingness to pay is defined by the maximum amount of $V$ that still satisfies the constraint, therefore

$$V^* = \frac{p_H}{\gamma} R - I + (1 - \frac{p_H^2}{p_H^2}) A_m.$$

Subcase 3: $\gamma A_m/p_H^2 > (\gamma A_m - B)/p_L^2 > B/(p_H^2 - p_L^2)$.

In the last subset of parameter values the RHS of equation (36) is simplified to $(\gamma A_m - B)/p_L^2$.

Following the same logic as in the preceding subcases we find that

$$V^* = \frac{p_H}{\gamma} (R + \frac{p_H B}{p_L}) - I + (1 - \frac{p_H^2}{p_L^2}) A_m.$$

\[ \square\]

**Proof of Proposition 5 (Comparative Statics for $A_{pe}^m - A_m$).**

First, from (28) and (13) we can express $A_{pe}^m - A_m$ as
\[ A_{m}^{pe} - A_{m} = \frac{p_{H}}{\gamma} (R - R_{pe}) + \frac{p_{H}}{\gamma} \left( \frac{b + c - B}{\Delta p'} \right) - \frac{p_{HC}}{\gamma_{pe} \Delta p}, \]
\[ = -\frac{p_{H}}{\gamma} (R_{pe} - R) - \frac{p_{H}}{\gamma} \left( \frac{B - b - c}{\Delta p'} \right) - \frac{p_{HC}}{\gamma_{pe} \Delta p}. \] (43)

By inspection of the equation above it is direct to see that if \( \Delta R_{pe} = R_{pe} - R \geq 0 \), a sufficient condition for \( A_{m}^{pe} - A_{m} < 0 \) is \( b + c - B < 0 \), that is, efficient monitoring. This guarantees that all the summands in (43) are negative. The necessary conditions are as follows. If \( \Delta R_{pe} \geq 0 \) then we need
\[
\frac{p_{H}}{\gamma} \left( \frac{B - b - c}{\Delta p'} \right) > \frac{p_{H}}{\gamma} (R_{pe} - R) + \frac{p_{HC}}{\gamma_{pe} \Delta p},
\]
\[
\frac{B - b - c}{\Delta p'} > (R_{pe} - R) + \frac{\gamma p_{HC}}{\gamma_{pe} \Delta p},
\]
\[
B - b - c > \Delta p' (R_{pe} - R) + \frac{\gamma p_{HC} \Delta p'}{\gamma_{pe} \Delta p}. \]

If \( \Delta R_{pe} < 0 \) we need \( \frac{p_{H}}{\gamma} (R - R_{pe}) < \frac{p_{H}}{\gamma} \left( \frac{B - b - c}{\Delta p'} \right) + \frac{p_{HC}}{\gamma_{pe} \Delta p} \) if monitoring is efficient.

Second, by differentiating (43) we find that
\[
\frac{\partial}{\partial \gamma} (A_{m}^{pe} - A_{m}) = -\frac{p_{H}}{\gamma} < 0,
\]
\[
\frac{\partial}{\partial R} (A_{m}^{pe} - A_{m}) = \frac{p_{H}}{\gamma} > 0,
\]
\[
\frac{\partial}{\partial B} (A_{m}^{pe} - A_{m}) = -\frac{p_{H}}{\gamma} \frac{1}{\Delta p'} < 0,
\]
\[
\frac{\partial}{\partial b} (A_{m}^{pe} - A_{m}) = \frac{p_{H}}{\gamma} \frac{1}{\Delta p'} > 0
\]
\[
\frac{\partial}{\partial c} (A_{m}^{pe} - A_{m}) = \frac{p_{H}}{\gamma} \frac{1}{\Delta p'} - \frac{p_{H}}{\gamma_{pe} \Delta p} \leq 0.
\]

Lastly, we need to show how \( \mu \) affects the difference in cutoffs. By differentiating equation (43) with respect to \( \mu \) we obtain
\[
\frac{\partial}{\partial \mu} (A_{m}^{pe} - A_{m}) = \frac{1}{\gamma} \left[ -\Delta R_{pe} - \frac{B - b - c}{\Delta p'} \left( 1 - \frac{p'_{H}}{\Delta p'} \right) \right] \frac{\partial p'_{H}}{\partial \mu} - \frac{p_{H}}{\gamma} \left( \frac{B - b - c}{\Delta p'} \right) \frac{\partial p'_{L}}{\partial \mu}.
\]

If we impose \( \frac{\partial}{\partial \mu} (A_{m}^{pe} - A_{m}) < 0 \), this requires
\[
\left[ -\Delta R_{pe} - \frac{B - b - c}{\Delta p'} \left( 1 - \frac{p'_{H}}{\Delta p'} \right) \right] \frac{\partial p'_{H}}{\partial \mu} < \frac{p_{H}}{\gamma} \left( \frac{B - b - c}{\Delta p'} \right) \frac{\partial p'_{L}}{\partial \mu}.
\]
Since we assume $\Delta R^{pe} \geq 0$ and $1 - \frac{\gamma}{\Delta p} < 0$ a sufficient condition is

$$\frac{B - b - c}{\Delta p'} \left( \frac{\gamma}{\Delta p'} - 1 \right) \frac{\partial \gamma}{\partial \mu} < \frac{\gamma}{\Delta p'} \left( \frac{B - b - c}{\Delta p'} \right) \frac{\partial \gamma}{\partial \mu},$$

which is precisely condition 1.

**Proof of Proposition 6 (Comparative Statics for $\overline{A}_m^{pe} - \overline{A}_m^{s}$)**

The difference between $\overline{A}_m^{pe}$ and $\overline{A}_m^{s}$ can be obtained using (28) and (40):

$$\overline{A}_m^{pe} - \overline{A}_m^{s} = -\frac{\gamma}{\gamma} (R^{pe} - b + c) - \frac{p_H c}{\gamma_{pe} \Delta p} + \frac{\gamma}{\gamma} \left( R^{s} - \frac{p_H}{p_H^2 - p_L^2} B \right)$$

$$= -\frac{\gamma}{\gamma} (R^{pe} - R^{s}) - \frac{p_H}{\gamma} \frac{p_H}{p_H + p_L} - \frac{b - c}{\gamma_{pe} \Delta p}.$$

As before, if $R^{pe} - R^{s} \geq 0$, it is direct to see that a sufficient condition for $\overline{A}_m^{pe} < \overline{A}_m^{s}$ is $-\frac{p_H}{p_H + p_L} B - b - c > 0$; this makes all the summands in the expression above negative.

Secondly, the comparative statics are as follows:

$$\frac{\partial (\overline{A}_m^{pe} - \overline{A}_m^{s})}{\partial R^{pe}} = \frac{\gamma}{\gamma} < 0,$$

$$\frac{\partial (\overline{A}_m^{pe} - \overline{A}_m^{s})}{\partial R^{s}} = \frac{\gamma}{\gamma} > 0,$$

$$\frac{\partial (\overline{A}_m^{pe} - \overline{A}_m^{s})}{\partial B} = -\frac{\gamma}{\gamma} \frac{p_H}{p_H + p_L} < 0,$$

$$\frac{\partial (\overline{A}_m^{pe} - \overline{A}_m^{s})}{\partial b} = \frac{\gamma}{\gamma} \frac{1}{\Delta p} > 0,$$

$$\frac{\partial (\overline{A}_m^{pe} - \overline{A}_m^{s})}{\partial c} = \frac{\gamma}{\gamma} \frac{p_H}{\gamma_{pe} \Delta p} \leq 0.$$

Lastly, by differentiating the expression above with respect to the misvaluation measure $\mu$ (which affects $p_H$ and $p_L$) we obtain

$$\frac{\partial (\overline{A}_m^{pe} - \overline{A}_m^{s})}{\partial \mu} = \frac{1}{\gamma} \left[ -(R^{pe} - R^{s}) + \frac{2p_H B(-p_H^2 + p_L^2 + p_H^2)}{(p_H^2 - p_L^2)^2} + \frac{b + c}{\Delta p'} \left( 1 - \frac{p_H}{\Delta p'} \right) \right] \frac{\partial p_H}{\partial \mu}$$

$$-\frac{p_H}{\gamma} \left( \frac{2p_H p_L B}{(p_H^2 - p_L^2)^2} - \frac{b + c}{\gamma_{pe} \Delta p^2} \right) \frac{\partial p_L}{\partial \mu}.$$
We impose $\frac{\partial (X^{pe}_m - X_m)}{\partial p} < 0$ which requires

$$[-(R^{pe} - R^s) + \frac{2p_Hp'_L^2B}{(p_H^2 - p_L^2)^2} + \frac{b + c}{\Delta p'} \left(1 - \frac{p'_H}{\Delta p'}\right) \partial p'_H/\partial \mu < p'_H \left[\frac{2p_Hp'_L^2B}{(p_H^2 - p_L^2)^2} - \frac{b + c}{\Delta p'}\right] \partial p'_L/\partial \mu].$$

Note that if we assume $(R^{pe} - R^s) \geq 0$ a sufficient condition is

$$\left[\frac{2p_Hp'_L^2B}{(p_H^2 - p_L^2)^2} + \frac{b + c}{\Delta p'} \left(1 - \frac{p'_H}{\Delta p'}\right) \partial p'_H/\partial \mu < p'_H \left[\frac{2p_Hp'_L^2B}{(p_H^2 - p_L^2)^2} - \frac{b + c}{\Delta p'}\right] \partial p'_L/\partial \mu\right]$$

Note that the last step assumes $\frac{2p_Hp'_L^2B}{(p_H^2 + p_L^2)} < (b + c)$ which is more demanding than $\frac{2p_Hp'_L^2B}{(p_H^2 + p_L^2)} < (b + c)$ since $\frac{2p_Hp'_L^2B}{(p_H^2 + p_L^2)} < 1$.

**Proof of Proposition 7 (Conditions under which $\nabla^{pe} > \nabla^s$)**

To prove this result first note that we need to deal with pricing equations that have at least one discontinuity, hence comparison is a priori not trivial. We shall assume throught this proof and without loss of generality that the IC holds in equilibrium. This means that the only possible equations determining the highest bid are the first and the second, in propositions 2 and 3.

Assume first that $(b + c)/\Delta p' < (b + c)/\Delta p$ and $B/(p_H^2 - p_L^2) < B/(p_H^2 - p_L^2)$. In this case only the second equation might arise since $(\gamma A_m + \gamma_{pe} A_{pe})/p_H > (b + c)/\Delta p$ and $\gamma A_m/p_H^2 > B/(p_H^2 - p_L^2)$. By (41), if $R^{pe} > R^s$ and $p'_H > p_H$ then $\nabla^{pe} > \nabla^s$.

Assume now that $(b + c)/\Delta p' > (b + c)/\Delta p$ and $B/(p_H^2 - p_L^2) > B/(p_H^2 - p_L^2)$. In this case both equations (25) and (26) for the PE case and (37) and (38) for a strategic acquirer might arise. To prove that indeed $\nabla^{pe} > \nabla^s$, note that the two equations for each bidder coincide when $(\gamma A_m + \gamma_{pe} A_{pe})/p_H = (b + c)/\Delta p'$ and $\gamma A_m/p_H^2 = B/(p_H^2 - p_L^2)$ respectively. If $(\gamma A_m + \gamma_{pe} A_{pe})/p_H \geq (b + c)/\Delta p'$ and $\gamma A_m/p_H^2 \geq B/(p_H^2 - p_L^2)$ then we need to compare (26) and (38). As before, if $R^{pe} > R^s$ and $p'_H > p_H$ then $\nabla^{pe} > \nabla^s$. If $(\gamma A_m + \gamma_{pe} A_{pe})/p_H < (b + c)/\Delta p'$ and $\gamma A_m/p_H^2 < B/(p_H^2 - p_L^2)$ then we need to compare (25) and (37). Note that this equivalent to comparing $\overline{X}^{pe}_m$ and $\overline{X}_m$, that is, if $\overline{X}^{pe}_m < \overline{X}_m$ then $\nabla^{pe} > \nabla^s$. In proposition 6 we showed that if $R^{pe} > R^s$ a sufficient condition for $\overline{X}^{pe}_m < \overline{X}_m$ is $\frac{\gamma_H}{\gamma_H + \gamma_L} B - (b + c) < 0$. Finally we would have to check two intermediate cases. First, the case where $(\gamma A_m + \gamma_{pe} A_{pe})/p_H \geq (b + c)/\Delta p'$ and $\gamma A_m/p_H^2 < B/(p_H^2 - p_L^2)$. However, if $(\gamma A_m + \gamma_{pe} A_{pe})/p_H \geq (b + c)/\Delta p'$ we know that (26) $\geq$ (25) $\geq$ (37) which is the reference equation when $\gamma A_m/p_H^2 < B/(p_H^2 - p_L^2)$. The second equality holds if $R^{pe} > R^s$ and $\frac{\gamma_H}{\gamma_H + \gamma_L} B - (b + c) < 0$. Finally, if $(\gamma A_m + \gamma_{pe} A_{pe})/p_H < (b + c)/\Delta p'$ and $\gamma A_m/p_H^2 \geq B/(p_H^2 - p_L^2)$.
\((\gamma A_m + \gamma_{pe} A_{pe}) / p_H < (b + c) / \Delta p'\) we know that \((25) > (26) > (38)\), where the last inequality is true if \(R^{pe} > R^s\) and \(p'_H > p_H\). □

**Proof of Proposition 8 (n projects).** First, note that because we assume that \((\gamma A_m - B) / p'^{i}_L \geq \gamma A_m / p'^{i}_H > B / (p'^{i}_H - p'^{i}_L)\), \(\forall n = \{1, 2, 3, \ldots\}\), we fall in the case where the IC constraint holds and the maximum bid amount is determined by the IR constraint binding. This is the equation of interest.

We follow the same reasoning as with two projects. For \(n = 3\), the incentive compatible investor belief requires that the manager is paid at least

\[
\text{Investor's view of (IC)} \quad R_m^s \geq 2B / (p'^{3}_H - p'^{3}_L)
\]  

(44)

If this condition holds then uninformed investors will invest \(3(\bar{V}^s + I - A_m)\) if they expect to earn \(\gamma\) on this investment. Thus,

\[
p'^{3}_H R_u^s + 3p'^{1}_H (1 - p'^{1}_H)^2 R^s + 6p'^{2}_H (1 - p'^{2}_H) R^s = 3\gamma(\bar{V}^s + I - A_m).
\]  

(45)

This equation can be further simplified since \(3p'^{1}_H (1 - p'^{1}_H)^2 R^s + 6p'^{2}_H (1 - p'^{2}_H) R^s = 3p'^{1}_H (1 - p'^{2}_H) R^s\). Note that in the equation above we use the fact that in case only one of the projects is successful the payoff to the investor is the entire cash flow available, \(R^s\). Hence the only unknown variable is \(R_u^s\).

Given the required return to investors, then manager earns

\[
R_m^s = 3R^s - R_u^s = 3R^s - 3\gamma(\bar{V}^s + I - A_m) - 3p'^{1}_H (1 - p'^{2}_H) R^s / p'^{3}_H
\]

Thus, the manager raises \(\bar{V}^s\) as high as possible subject to the following constraint,

\[
3R^s - 3\gamma(\bar{V}^s + I - A_m) / p'^{3}_H + 3p'^{1}_H (1 - p'^{2}_H) R^s / p'^{3}_H \geq 3\gamma A_m / p'_H
\]

Rearranging terms we obtain

\[
\bar{V}^s = \frac{p'_H}{\gamma} R^s - I + A_m - \left(\frac{p'_H}{p_H}\right)^3 A_m
\]

It is easy to realize that for \(n\) projects this becomes

\[
\bar{V}^s_n = \frac{p'_H}{\gamma} R^s - I + A_m - \left(\frac{p'_H}{p_H}\right)^n A_m
\]

38
The limit expression in the proposition is direct, except for the first limit. Note that when \( p_H' > p_H \), \( \lim V_n^s = -\infty \). Since the maximum price can only be non-negative, the well-defined maximum willingness to pay in the case of overvalued debt would be 0, hence \( \lim V_n^s = 0 \).

Model of Section III.E

Recall that with two projects, one optimal contract requires the manager to invest \( 2A_m \), and the uninformed investors to invest the balance of \( 2(V^s + I - A_m) \). The contract then pays everyone nothing if both projects fail, pays the manager nothing if one project fails, and if both projects succeed divides the payoff \( 2R^s \) into \( R_m^s > 0 \) for the manager and \( R_u^s > 0 \) for the uninformed investor, such that \( R_m^s + R_u^s = 2R^s \).

Uninformed investors will only invest if they believe the manager will choose the good projects. Now, however, the manager only gets paid if both projects pay off thus investors need only believe that \( p_H^2 R_m^s \geq p_L^2 R_m^s + 2B \). Therefore, the incentive compatible investor belief requires that the manager is paid at least \( R_m^s \geq 2B/(p_H^2 - p_L^2) \).

Even though this is an optimal contract it could be that the parameter values are such that there exists no \( R_u^s \geq 0 \) such that

\[
p_H^2 R_u^s + 2p_H'(1-p_H') R_u^s > 2\gamma(V^s + I - A_m).
\]  

This can happen whenever

\[
2p_H'(1-p_H') R_u^s > 2\gamma(V^s + I - A_m).
\]

In that case, and given that \( R_u^s \) must be non-negative, the optimal contract which pays nothing to the manager if only one project is successful, is not feasible. Therefore, the equilibrium contract is of the form \( (R_u^s, R_{ui}^s) \) where the pair denotes payments to uninformed investors whenever both projects are successful or only one is, respectively. Hence the investor’s IR becomes

\[
p_H^2 R_u^s + 2p_H'(1-p_H') R_{ui}^s = 2\gamma(V^s + I - A_m)
\]

Given the required return to investors, then manager earns \( (R_m^s, R_{mi}^s) \) where the vector of payoffs refers to the payoff in case both projects are successful and only one is, respectively; that is,

\[
R_m^s = 2R^s - R_u^s
\]

\[
= 2R^s - 2\gamma(V^s + I - A_m) - 2p_H'(1-p_H') R_{ui}^s / p_H^2
\]

if both projects are successful and

\[
R_{mi}^s = R^s - R_u^s
\]
Lemma 4. We will from now on focus on the case where the IC holds, without loss of generality. And investors will only provide funding for the project if they believe the manager will choose the projects if only one is. Given the required uninformed investor returns the manager will only choose the better holds, otherwise the manager would rather invest $A$ projects that earn $V$. Therefore, the manager’s individual rationality constraint is

$$\text{Manager (IR)} \begin{cases} R_m + 2 \frac{1-p_H}{p_H} R_{mi}^s \geq 2 \gamma A_m/p_H^2 & \text{if Manager IC holds} \\ R_m + 2 \frac{1-p_L}{p_L} R_{mi}^s \geq 2(\gamma A_m - B)/p_L^2 & \text{if Manager IC does not hold} \end{cases}$$  \hspace{1cm} (48)$$

Thus, the manager raises $\bar{V}^s$ as high as possible subject to the following constraint,

$$2R^s - 2\gamma(\bar{V}^s + I - A_m)/p_H^2 + 2(1 - p_H)R_{ui}/p_H^2$$

$$\geq \max \left\{ 2B/(p_H^2 - p_L^2) - 2 (p_H'(1 - p_H') - p_L'(1 - p_L')) R_{mi}^s/(p_H^2 - p_L^2), \min[2\gamma A_m/p_H^2 - 2 \frac{1-p_H}{p_H} R_{mi}^s, 2(\gamma A_m - B)/p_L^2 - 2 \frac{1-p_L}{p_L} R_{mi}^s] \right\}.$$  

We will from now on focus on the case where the IC holds, without loss of generality.

Lemma 4. The highest $\bar{V}^s$ a manager in a strategic acquisition is willing to pay is defined by

$$\bar{V}^s = \frac{p_H^2}{\gamma p_H} R^s - I + \frac{R_{ui}}{\gamma} \left[ (1 - p_H')p_H - \frac{(1-p_H)p_H^2}{p_H} \right] + (1 - p_H') A_m$$

$$\geq \gamma A_m/p_H^2 - 2 \frac{1-p_H}{p_H} R_{mi}^s$$

$$\geq B/(p_H^2 - p_L^2) - 2 (p_H'(1 - p_H') - p_L'(1 - p_L')) R_{mi}^s/(p_H^2 - p_L^2)$$

Proof of proposition 9 (Non-debt equilibrium contract)

To prove the result we need to show that

$$\Delta \equiv \left( \frac{p_H^2}{p_H} - p_H' \right) R^s + R_{ui} \left[ (1 - p_H')p_H - \frac{(1-p_H)p_H^2}{p_H} \right] \geq 0.$$
This is the difference between the two pricing equations (debt and alternative contract). We will prove this claim with an *a fortiori* argument. That is, we know that $R^s_{ui} \leq R^s$. Also, $(1-p'_H)p'_H - \frac{(1-p_H)p_H'}{p_H} < 0$ and $\frac{p_H'}{p_H} - \frac{p_H'}{p_H} > 0$ with overvaluation ($p'_H > p_H$). Assume that $R^s_{ui} = R^s$. Then it is easy to obtain that $\Delta = 0$. This is what we expect since $R^s_{ui} = R^s$ is the optimal debt contract. If we lower $R^s_{ui}$ by $dx$ the total change to $\Delta$ is $-dx \left[ (1-p'_H)p'_H - \frac{(1-p_H)p_H'}{p_H} \right] > 0$. Because $\Delta$ is linearly decreasing in $R^s_{ui}$, $\Delta \geq 0 \forall R^s_{ui} \leq R^s$. 