Acquisition Values and Optimal Financial (In)Flexibility*

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April 2008

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This paper analyzes optimal financial structure for an incumbent and potential entrant accounting for prospective asset mergers. Exercising a first-mover advantage, the incumbent increases his share of surplus by issuing long-term debt that appreciates in the event of merger. The incumbent also limits the prospective entrant's access to merger surplus with a covenant prohibiting assumption of additional long-term debt in the event of merger. If entry occurs, the entrant has high short-term cash obligations, but accomodates the incumbent covenant by issuing zero long-term debt. Incumbent leverage tightens financing constraints and reduces the likelihood of entry. However, high incumbent leverage has a counterveiling cost since the resulting debt overhang prevents ex post efficient mergers when total managerial control benefits are high. The incumbent chooses high (low) long-term debt if total expected control benefits are low (high). The optimal venture capital contract depends upon incumbent leverage, with stronger financier ownership rights if the incumbent has low debt.

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This paper analyzes optimal financial structure for an incumbent and potential entrant accounting for prospective asset mergers. Exercising a first-mover advantage, the incumbent increases his share of surplus by issuing long-term debt that appreciates in the event of merger. The incumbent also limits the prospective entrant's access to merger surplus with a covenant prohibiting assumption of additional long-term debt in the event of merger. If entry occurs, the entrant has high short-term cash obligations, but accommodates the incumbent covenant by issuing zero long-term debt. Incumbent leverage tightens financing constraints and reduces the likelihood of entry. However, high incumbent leverage has a countervailing cost since the resulting debt overhang prevents ex post efficient mergers when total managerial control benefits are high. The incumbent chooses high (low) long-term debt if total expected control benefits are low (high). The optimal venture capital contract depends upon incumbent leverage, with stronger financier ownership rights if the incumbent has low debt.

Keywords: Entry, Acquisitions, Mergers, Financial Contracting, Product Market Competition.

JEL: G32, G34.

According to conventional wisdom, the deep pockets of an incumbent deter entry. In this view, potential entrants fear the incumbent will utilize financial slack to finance predatory behavior, e.g. advertising targeted against rivals. A theoretical foundation for this view can be found in the model developed by Bolton and Scharfstein (1990) which shows that a cash-rich incumbent can alter the shape of venture capital contracts and lower entrant returns using the threat of predation financed with internal funds.

Importantly, Bolton and Scharfstein (1990) rule out the possibility of the incumbent acquiring the entrant's assets or vice-versa and specify asset values exogenously. In this paper, we consider optimal financial structures for an incumbent and potential entrant when there is an active secondary market for both firm's assets. The asset "mergers" in our model approximate a wide range commonplace methods for unifying firms' assets under a single umbrella, e.g. acquisitions, hostile takeovers, LBOs, trade-sales, and/or bankruptcy auctions. These markets are pervasive. For example, Gompers (1995) finds that the majority of VC-backed projects end in either trade sales (38%) or bankruptcy auctions (25%). In both cases, an incumbent is a natural asset buyer. Shleifer and Vishny (1992) argue that, "When firms have trouble meeting debt payments and sell assets or are liquidated, the highest valuation potential buyers of these assets are likely to be other firms in the industry." More generally, even those start-ups that go public have the potential to acquire or be acquired by more mature firms within their industry.

In the model, the entrant and incumbent will evenly split the bilateral surplus coming from any asset merger, provided it is positive. Total merger surplus is equal to the increase in total cash flow minus the loss in non-monetary control benefits for the owner/manager of the acquired firm. The working assumption in the model is that merger is always ex post efficient. This implies that a merger will always occur provided there are no third-party spillovers, such as those resulting from debt overhang. In order to deter entry, the incumbent would like to claim that it will never engage in asset mergers, since they boost entrant returns. However, such a claim is not credible (subgame perfect) if both firms are unlevered.

To motivate this paper's results on optimal leverage and bond covenants, consider a bargaining game with equally strong parties (Leader and Follower) anticipating the division of a pie with eight slices worth a dollar each, with failure to reach agreement resulting in no pie for either. In this game, each party receives four slices. Next, modify the game by endowing one party, Leader, with the ability to move prior to bilateral bargaining with Follower, writing a third-party contract pledging one of the eight slices to a third-party, payable if and only if Leader and Follower subsequently reach agreement. When Leader and Follower bargain, they correctly compute the bilateral surplus from agreement as 7 (=8-1). Leader and Follower each receive 3.5 slices, but Leader also captures the one dollar value of the contract he sold to the third-party. In this way, the third-party contract increases Leader's share of total surplus.

Of course, if Follower could write an identical third-party contract, he would do so and both parties would again receive four dollars in total value. However, Leader would rationally anticipate this action on the part of Follower. He could block Follower's subsequent attempt at surplus extraction by including in his own third-party contract a clause prohibiting any bargaining with Follower if the latter has pledged any value to third-parties. In such a game, Leader again obtains a value of 4.5.[1]

It is shown that long-term (public) debt can be used by firms as a device for increasing their respective share of the total surplus created by asset mergers. As first-mover, the incumbent enjoys a strategic advantage. In particular, he can use his own debt to crowd out that of the entrant. Further, the incumbent can attach an event risk covenant prohibiting merger with the entrant if the latter has any long-term debt. As second-mover, the entrant has no choice but to conform to the incumbent's covenant, and she takes on zero long-term debt.

Our model highlights the following tradeoff faced by the incumbent in choosing his debt level. By choosing high debt, the incumbent extracts a larger share of total surplus in the event of an

[1] Dasgupta and Sengupta (1993) and Hennessy and Livdan (2008) have similar motivating examples in the context of firm-worker bargaining. However, in their models only one party has the power to write a third-party contract ex ante, ruling out the strategic interactions that are central to our model.

asset merger. In addition to the obvious direct benefit conferred, this surplus extraction also deters entry. However, by taking on high debt the incumbent also risks preventing a merger if total merger surplus is low, as would be the case if managerial control benefits are high. Such an outcome is costly to the incumbent since he then faces product market competition.

To examine the interplay between incumbent and entrant financing policies, we consider a setting in which the owner-manager of the entrant has zero wealth and must raise entry costs from a venture capitalist. The venture capital contract is conditioned by incumbent financial structure, but the nature of the relationship is the opposite of the traditional view (e.g. Bolton and Scharfstein, 1990). In our model, the cash flows from the entrant production technology are privately observed by the owner-manager. The venture capital contract uses ownership rights as a carrot to induce the manager to deliver a portion of first-stage returns to the financier. In this setting, high debt of the incumbent tightens the financing constraint through two distinct channels. First, if the incentive contract calls for the manager to forfeit ownership, the venture capitalist receives a lower price in his asset sale (e.g. bankruptcy auction) if the incumbent has high debt. The second channel is more subtle. If the incumbent has high debt, the manager places a lower value on retaining ownership – since there is less residual surplus for him to capture in the event of asset merger. Further, since the manager of the entrant is more likely to attach high value to asset control, an asset merger is less likely to generate positive bilateral surplus if the incumbent is heavily indebted. This souring of the carrot reduces managerial incentives and forces the venture capitalist to give stronger ownership rights to his manager. Both effects reduce the venture capitalist's expected return, reducing the likelihood of entry.

Our model is most closely related to that developed by Bolton and Scharfstein (1990). Both models consider a self-financed incumbent (with a "long purse") facing the threat of entry by an entrepreneur reliant upon outside financing (in an optimal contracting environment with hidden cash flows). The model of Bolton and Scharfstein offers a rigorous foundation for the traditional argument in favor of incumbents maintaining a deep pocket. The difference in conclusions between

the two models stems from two critical differences in underlying assumptions. First, Bolton and Scharfstein consider a setting where the only punishment available to the financier is to "liquidate" the project at an exogenous payoff of zero. Their second assumption, related to the first, is that the incumbent cannot acquire the entrant's assets or vice-versa. The assumptions of Bolton and Scharfstein are appropriate in settings where regulators prohibit all forms of asset acquisitions. However, the empirical evidence cited above suggests that asset mergers are common, although their labeling varies. Further, in the U.S., regulators are often willing to waive antitrust objections for firms in financial distress.

Central to the transmission mechanism in this paper is that the incumbent potentially influences secondary market values, even when he is the target rather than the acquirer. Faure-Grimaud (2000) and Povel and Raith (2004) generalize the model of Bolton and Scharfstein model to a continuous profit space. In their models, the liquidation payoff is positive, but exogenous. In our model, the entrant contract calls for rewards and punishments using ownership rights rather than liquidation threats. Regardless of who has ownership rights, they maximize the value they get from the assets and will engage in asset merger if there is positive bilateral surplus from doing so.

The model shares with Shleifer and Vishny (1992) a focus on the relationship between financial structure and secondary market prices. However, Shleifer and Vishny examine the interplay between financing decisions made by two firms already in the industry. Our paper examines the interplay between the financial structures of an entrant and an incumbent. The model of Shleifer and Vishny contains a similar benefit to maintaining deep pockets, in that low-debt firms maintain the ability to purchase the assets of competitors. However, the *cost* of maintaining deep pockets differs fundamentally. Shleifer and Vishny assume the firm is managed (but not owned) by an empire-builder, implying that deep pockets exacerbate overinvestment. This argument is used to rationalize the use of debt. Zwiebel (1996) argues that, in the absence of a takeover threat, an empire-building manager would never take on debt. In contrast, we follow Bolton and Scharfstein (1990) in assuming the incumbent is self-financed. Thus, our model rationalizes the use of debt without relying upon

manager-shareholder agency conflicts.

The paper is naturally related to the model of Myers (1977) since all effects of leverage stem from externalities accruing to lenders. An important contribution of Myers' model is that it explains why growth firms avoid debt. However, it fails to explain why firms issue debt. In his model, optimal debt is zero, and strictly so for a firm holding any growth options. In contrast, our model demonstrates two benefits of debt overhang: surplus extraction and entry deterrence. The latter benefit is shown to be particularly large for value firms. This novel explanation for the use of public debt is robust to Zwiebel's (1996) critique of agency-based theories and Miller's (1977) critique of tax-based theories.

Dasgupta and Sengupta (1993) derive a bargaining benefit of debt in a game where only one party, an employer, has the power to issue debt. The tradeoffs in their model differ fundamentally. In their model, debt reduces incentives since the worker fears he will not be paid in the event of default. Our model is also related to that of Muller and Panunzi (2004), who show that debt issuance can be used by a raider to overcome the free-rider problem in takeovers of widely-held firms. In both models, debt helps to extract surplus. Our model abstracts from the free-rider problem by considering closely-held firms. The first important difference between the models is that we consider the entry-deterrence value provided by debt issuance. Second, we allow for strategic interaction in debt levels and financial contracts. Finally, our model highlights a key cost of high debt, the prevention of ex post efficient asset mergers.

Our model is related to, but logically distinct from, existing papers arguing that debt serves as an entry deterrent. This literature is uniformly based on the premise that leverage encourages an incumbent to be more aggressive in quantity or price setting. As shown by Brander and Lewis (1986) and Maksimovic (1988), limited liability causes equity to consider only non-default states in choosing its optimal strategy. This may encourage the levered firm to choose a more aggressive policy than an unlevered firm. McAndrews and Nakamura (1992) and Fulghieri and Nagarajan (1996) argue that such effects make debt an entry deterrent. However, as discussed below, the effect of debt on the firm's pricing and output strategies is sensitive to the product market setup. Further,

existing empirical evidence suggests that, if anything, levered firms are less aggressive in setting prices and quantities.

First, Showalter (1995) shows the effect of debt on quantity in a static Cournot game changes sign according to whether non-default states correspond to high demand or low costs. Faure-Grimaud (2000) and Povel and Raith (2004) show the effect of debt in a static Cournot game is sensitive to whether absolute priority is obeyed in default. Different results are also obtained in multi-period models. Whereas in many dynamic models debt fosters competition (e.g. Maksimovic, 1988), in the model of Chevalier and Scharfstein (1996), debt induces less aggressive behavior as the prospect of default reduces investments in market share. In a closely related paper, Dasgupta and Titman (1998) find that the effect of leverage on behavior in product markets depends upon whether the firm is a Stackelberg leader.

Second, theories predicting that leverage induces aggressive quantity or price setting are at odds with a large body of empirical evidence. Chevalier and Scharfstein (1996) find that supermarket chains that undertook leveraged buyouts cut prices less aggressively in downturns. Campello (2003) finds that high leverage firms tend to lose market share to low leverage firms during downturns. Similar evidence is presented by Phillips (1994), Chevalier (1995a, 1995b), Zingales (1998) and Khanna and Tice (2005).

The basic causal mechanism in our model is robust to these critiques. This is because the proposed theory of entry deterrence invokes a radically different transmission channel, namely, the levered incumbent uses debt to limit the entrant's access to the surplus generated by asset mergers. In the interest of logical clarity, our model deliberately rules out any direct effect of leverage on price or quantity decisions.

Section 1 presents the basic model and Section 2 discusses various extensions. Section 3 discusses related empirical evidence.

1. The Model

1.1. Timing and Payoffs

The discount rate is zero and all agents are risk neutral. Throughout, capital letters denote the incumbent and lowercase letters denote the entrant. Upper bars denote expected values.

The incumbent firm I is initially owned and operated by manager M. In order to abstract from the free-rider problem, there are no outside shareholders. We follow Bolton and Scharfstein (1990) in assuming the incumbent faces has infinite outside wealth and faces no "financing constraints." In particular, the incumbent has already made whatever sunk investment was necessary to enter the market and has no debt outstanding initially. Further, the cash flows generated by the incumbent's production technology are publicly observable.

There are two periods of potential product market competition taking place at times t_1 and t_2. At time t_{-1}, M has the ability to implement a publicly observed leveraged recapitalization. Alternative timing assumptions regarding incumbent debt issuance are discussed in Section 2. In the recapitalization, all proceeds raised from the flotation of a zero coupon long-term bond will be distributed as a dividend. Long-term debt markets are perfectly competitive. The face value of incumbent debt is B, with payment due to creditor C at time t_2^+ after second period product market competition. This maturity assumption is adopted without loss of generality since any short-term debt obligation of firm I would have no effect on final payoffs. Creditor C has a senior claim to the second period cash flow of firm I. The only covenant in the bond is a prohibition on firm I itself issuing any additional debt, in order to limit expropriation of C ex post. The bond contains no covenant restricting dividend payments out of I's cash flows from period t_1. Such a covenant would only serve to destroy value by undoing I's initial debt choice.

Section 1 rules out covenants restricting mergers. The effect and optimal form of such covenants is considered in Section 2. In the event of a merger, all outstanding debts will be placed on equal priority. In fact, this seniority assumption will be irrelevant once we allow the firms to write covenants restricting mergers.

Following Hart (1991) and Shleifer and Vishny (1992), long-term debts are public and not renegotiable. As argued by Smith and Warner (1979), the strictures of the Trust Indenture Act

(TIA) make it difficult to renegotiate public debt. In particular, TIA requires bondholder unanimity in order to change any core term of an indenture. Aside from coordination issues, the unanimity requirement in TIA encourages lenders to free-ride, making renegotiation more difficult. Consistent with these arguments, Gilson, John and Lang (1990) and Asquith, Gertner and Scharfstein (1994) find that public debt is the single best predictor of failed private workouts.

In the next period (t_0), a single potential entrant firm e, with initial manager-owner m, will attempt to enter the market after observing the financial structure of the incumbent. Assumptions regarding the observability of entrant cash flows are the same as those adopted by Bolton and Scharfstein (1990). Entry requires a single investment in physical capital k. At time t_0, the cost k is drawn from $[0, \infty)$ with p.d.f. $z(\cdot)$ and c.d.f. $Z(\cdot)$. The distribution of k has no atoms and satisfies $z(k) > 0$ for all $k \in [0, \infty)$. When the incumbent makes his leverage decision at date t_{-1} he only knows the distribution of k.

If firm e operates as a competitor to firm I, it will generate cash flows that are not observable by outside investors. Firm e's duopolistic cash flows in period t_1 are π_1 distributed continuously on $[0, \pi_1^{\max}]$ following a strictly positive and atomless probability density function f. In period t_2, firm e's duopolistic cash flows are a random variable $\pi_2 \in [0, \pi_2^{\max}]$.

If there is no competitor in the market in period t_1, the incumbent's production technology generates a random monopoly cash flow Π_1^m. If there is a competitor in the market in t_1 the incumbent's production technology generates a random duopoly cash flow Π_1^d. In period t_2, the incumbent's production technology generates a monopoly cash flow Π_2^m if there is no competitor and Π_2^d if there is a competitor. Second-stage cash flows are drawn from $[0, \infty)$. The cash flow Π_2^m has p.d.f. g and c.d.f. G. The cash flow Π_2^d has p.d.f. h and c.d.f. H. There are no atoms in the distributions G and H of second-stage cash flows. Monopoly cash flow is first-order stochastic dominant:

$$A1 : G(\Pi_2) < H(\Pi_2) \quad \forall \quad \Pi_2 \in [0, \infty). \tag{1}$$

Since firm e is the only potential entrant, the incumbent enjoys a monopoly in both periods if e does not enter at time t_0. If e does enter, the incumbent will *necessarily* face product market

competition in period t_1 with buyout prior to entry impossible. Intuitively, one can think of there being an infinite number of entrepreneurs who can costlessly claim to have a viable competitor technology, with a single unknown entrepreneur being credible. In this setting, the incumbent cannot afford to pay off all potential competitors ex ante. Rather, he must wait until after t_1 to identify the bona fide competitor. If e enters, the incumbent does not necessarily face competition in period t_2. This is because just prior to period t_2, at time t_2^-, the owners of firms I and e have the option to merge. If there is a merger, the merged firm cash flow is Π_2^m.

Manager m has no wealth and must turn to a venture capitalist, vc, for funding. The vc holds all bargaining power in his negotiations with m. This assumption is without loss of generality since we are interested in identifying conditions under which the financier will be willing to fund entry. The maximum funding possible is that which obtains when the financier has all bargaining power. Further, it is natural to think that venture capitalists enjoy high bargaining power since their skills and capital are scarce relative to the number of entrepreneurs who fancy themselves as having a great business concept. The same bargaining power assumption is adopted by Bolton and Scharfstein (1990), and for the same reasons, in their analysis of optimal entrant contracts.

The financial contract between the vc and m is written at time t_0 when the entry cost k is observed. The space of legally enforceable contracts consists of a reimbursement schedule r that m pays to vc from the first-stage (t_1) cash flow and a reward probability β, with both based upon a cash flow report by m. The reward β is the probability of m retaining ownership of the firm at time t_1^+. The set of contracts is not limited to deterministic schemes: the fact that the reward is stochastic reflects the fact that, at a theoretical level, deterministic schemes are dominated. Further, randomization has an interesting economic interpretation, in that it approximates the type of deviations from absolute priority that are routinely observed in bankruptcies.

In addition to cash flows, asset control generates non-monetary benefits accruing at time t_2. Manager M captures a nonstochastic control benefit Y if he is a manager in period t_2. The vc has a low nonstochastic control benefit $y = y_l$. Manager m captures a stochastic control benefit

$y \in \{y_l, y_h\}$ if he is a manager in period t_2. The probability of y_h is $\theta \in (0,1)$. The realized value of y is first observed by m at time t_2^{--}, after the first-stage profit report and just prior to any merger negotiation. In the merger negotiation at time t_2^{-}, the realized value of y becomes common knowledge.

Control benefits satisfy

$$A2 : 0 < y_l < Y < y_h.$$

The existence of non-monetary control benefits creates a merger cost, since there will be only one asset manager post-merger. However, merger is always ex post efficient under the maintained assumption

$$A3 : \overline{\Pi}_2^m > \overline{\Pi}_2^d + \overline{\pi}_2 + Y.$$

In contrast to earlier work on optimal entrant contracts, we derive endogenously the values that the financier and manager attach to ownership. Further, we allow the ultimate owner of the entrant's assets to issue long-term debt to a third-party. This debt is issued at time t_2^{--}, just after y is observed by m and just prior to the merger decision. The face value of firm e's debt b is due at time t_2^{+}. The corresponding creditor is denoted c and there is no possibility for renegotiation.

Endowing the entrant owner with the ability to issue debt against second period cash flow is important since it increases the share of merger surplus that can be extracted. This relaxes the entrant's financing constraint through two channels. First, vc is able to obtain a higher total payoff if he gains ownership. Second, m is more willing to deliver first-stage cash flows to vc since she attaches greater value to her ownership rights.

Using appropriate stock conversion ratios, the bilateral surplus from any merger will be divided evenly between M and the entrant owner (vc or m). For example, a targeted firm will receive more favorable exchange terms to compensate its manager for forfeiting control benefits. The division of surplus can be understood as arising from a repeated offers bargaining game or from Nash's axiomatic formulation.

Under $A3$ merger would always occur if $b = B = 0$. To see this, suppose first $y = y_l$. In this case,

the incumbent would acquire the entrant with M serving as manager of the newly formed entity. The bilateral merger surplus would be

$$S = \overline{\Pi}_2^m + Y - [\overline{\Pi}_2^d + Y + \overline{\pi}_2 + y_l] = \overline{\Pi}_2^m - \overline{\Pi}_2^d - \overline{\pi}_2 - y_l > 0.$$

If $y = y_h$, the the bilateral surplus from merger is lower since a larger control benefit is sacrificed. In this case, the entrant would acquire the incumbent with m serving as manager. The bilateral surplus would be

$$S = \overline{\Pi}_2^m + y_h - [\overline{\Pi}_2^d + Y + \overline{\pi}_2 + y_h] = \overline{\Pi}_2^m - \overline{\Pi}_2^d - \overline{\pi}_2 - Y > 0.$$

1.2. Debt Overhang and the Viability of Mergers

The model is solved by backward induction. We begin by analyzing the merger decision accounting for any long-term debt obligations. Recalling that the merged entity assumes the debt obligations of firms I and e, the market value of the debt of the monopolist, evaluated at time t_2^-, would be

$$L_m(b+B) \equiv \int_0^{b+B} \Pi g(\Pi) d\Pi + (b+B)[1 - G(b+B)]. \tag{2}$$

If the merger did not occur, the debt obligation of firm I would have market value equal to

$$L_d(B) \equiv \int_0^{B} \Pi h(\Pi) d\Pi + B[1 - H(B)]. \tag{3}$$

If the merger did not occur, the debt obligation of firm e would be worth zero since the manager-owner of e would always report that the second-stage cash flows from the duopoly was zero.

Consider now the merger decision if the entrant's owner has low control benefits. In this case, it would be optimal to let M serve as manager and the bilateral surplus from merger would be

$$S = \overline{\Pi}_2^m - \overline{\Pi}_2^d - \overline{\pi}_2 - y_l - [L_m(b+B) - L_d(B)]. \tag{4}$$

The preceding equation shows that long-term debts threaten the merger via two channels, with both related to positive externalities that a merger would confer upon creditors C and c. First, if $b = 0$

there is a debt overhang effect arising from the fact that creditor C would benefit with the shift from duopoly to monopoly since $L_m(B) > L_d(B)$. Second, creditor c necessarily realizes a positive externality from merger since his claim is worth zero under duopoly and worth $b(b+B)^{-1}L_m(b+B)$ under the post-merger monopoly.

Consider next the merger decision if the entrant's owner has high control benefits. In this case it would be optimal to let m serve as manager and the bilateral surplus from merger would be

$$S = \overline{\Pi}_2^m - \overline{\Pi}_2^d - \overline{\pi}_2 - Y - [L_m(b+B) - L_d(B)]. \tag{5}$$

Again, we see that debt overhang from outstanding long-term debts threatens the merger, with the problem being more acute if $y = y_h$ since total merger surplus is lower.

It is convenient to define a (relatively) high level of incumbent debt such that there would be exactly zero bilateral surplus from merger even if $b = 0$ and $y = y_l$. To this end, let $B_H \in (0, \infty)$ denote the unique solution to

$$\overline{\Pi}_2^m - \overline{\Pi}_2^d - \overline{\pi}_2 - y_l = [L_m(B_H) - L_d(B_H)]. \tag{6}$$

Note that if the incumbent chooses B_H a merger will occur if and only if $b = 0$ and $y = y_l$. This foreshadows the key cost of high debt, preventing mergers when there are high control benefits.

Next define a (relatively) low level of incumbent debt such that there would be exactly zero bilateral surplus from merger if $b = 0$ and $y = y_h$. Let $B_L \in (0, B_H)$ denote the unique solution to

$$\overline{\Pi}_2^m - \overline{\Pi}_2^d - \overline{\pi}_2 - Y = [L_m(B_L) - L_d(B_L)]. \tag{7}$$

Note that if $y = y_l$ and the incumbent were to choose B_L while the entrant chose $b = 0$, there would be strictly positive bilateral surplus from merger with

$$S = \overline{\Pi}_2^m - \overline{\Pi}_2^d - \overline{\pi}_2 - y_l - [L_m(B_L) - L_d(B_L)] = Y - y_l. \tag{8}$$

The preceding equation foreshadows the key cost of low debt in our model. By taking on low debt the incumbent leaves "residual surplus", a portion of which can be captured by the entrant. In

addition to increasing the premium that must be paid to the entrant, this effect also encourages entry.

1.3. Optimal Long-Term Debt for Entrant

Let $b_l^*(B)$ and $b_h^*(B)$ denote the optimal long-term debt commitment of the entrant conditional upon incumbent debt when control benefits are low and high, respectively. We begin first by characterizing the optimal entrant reaction function under y_l. For all $B > B_H$, $b_l^*(B) = 0$ since in this case merger surplus is negative. Here the entrant's owner will simply receive his reservation value of $\overline{\pi}_2 + y_l$. Consider next an arbitrary $B \in (0, B_H)$. For any b sufficiently low such that bilateral surplus is positive, the value of the claim held by the entrant's owner, denoted Ω, is equal to the sum of the value of his debt flotation plus his reservation value plus one-half the bilateral surplus from merger:

$$\begin{aligned} \Omega(b,B) \equiv & \left[\frac{b}{b+B}\right] L_m(b+B) + [\overline{\pi}_2 + y_l] \\ & + \frac{1}{2}\left[\overline{\Pi}_2^m - \overline{\Pi}_2^d - \overline{\pi}_2 - y_l - L_m(b+B) + L_d(B)\right]. \end{aligned} \tag{9}$$

This function is strictly increasing in its first argument on the interval under consideration, with

$$\Omega_1(b,B) = \frac{1 - G(b+B)}{2} + \frac{B}{(b+B)^2}\int_0^{b+B} \Pi g(\Pi) d\Pi > 0. \tag{10}$$

It follows that for all $B \leq B_H$ the optimal entrant long-term debt is $b_l^*(B) = b_l^{crit}(B)$ where the latter is the unique solution to the equation

$$\overline{\Pi}_2^m - \overline{\Pi}_2^d - \overline{\pi}_2 - y_l - L_m[b_l^{crit}(B) + B] + L_d(B) = 0. \tag{11}$$

Under this reaction function, when the incumbent chooses the low debt B_L and control benefits are y_l, the entrant achieves a payoff equal to

$$\begin{aligned} \Omega[b_l^*(B_l), B_L] &= \overline{\pi}_2 + y_l + \frac{1}{2}(Y - y_l) + \eta \\ \eta &\equiv \int_0^{b_l^*(B_L)} \Omega_1(b, B_L) db > 0. \end{aligned} \tag{12}$$

When the incumbent chooses B_L and control benefits are y_l, the entrant achieves a value equal to his reservation value plus one-half the residual surplus left free by the incumbent plus an additional amount stemming from his strategic issuance of long-term debt.

Consider next the entrant reaction function when control benefits are y_h. For all $B > B_L$, $b_h^*(B) = 0$ since there is no possibility of a merger and the entrant's owner will simply receive his reservation value of $\overline{\pi}_2 + y_h$. Consider next an arbitrary $B \in (0, B_L)$. For any b sufficiently low such that merger surplus is positive, the value of the claim held by the entrant's owner is:

$$\begin{aligned} \widetilde{\Omega}(b, B) \quad \equiv \quad & \left[\frac{b}{b+B}\right] L_m(b+B) + [\overline{\pi}_2 + y_h] \\ & + \frac{1}{2}\left[\overline{\Pi}_2^m - \overline{\Pi}_2^d - \overline{\pi}_2 - Y - L_m(b+B) + L_d(B)\right]. \end{aligned} \tag{13}$$

Differentiating $\widetilde{\Omega}$ we find that this function is strictly increasing in b on the interval under consideration since $\widetilde{\Omega}_1 = \Omega_1$. It follows that for all $B \leq B_L$ the optimal entrant long-term debt is $b_h^*(B) = b_h^{crit}(B)$ where the latter is the unique solution to the equation

$$\overline{\Pi}_2^m - \overline{\Pi}_2^d - \overline{\pi}_2 - Y - L_m[b_h^{crit}(B) + B] + L_d(B) = 0. \tag{14}$$

The following lemma summarizes the results of this subsection.

Lemma 1. *If entrant control benefits are low (high) and the face value of incumbent debt is strictly less than B_H (B_L), the entrant optimally issues sufficient long-term debt to drive bilateral merger surplus down to zero.*

From Lemma 1 it follows that the optimal incumbent debt is

$$B^* \in \{B_L, B_H\}. \tag{15}$$

In lieu of a formal proof, we here sketch the argument. Since the long-term debt is fairly priced, the total value received by M if there is no merger is simply firm I's total cash flow plus the control benefit Y. If there is a merger, the incumbent receives total firm value including the control benefit $max\{y, Y\}$ less the value captured by the entrant. Therefore, a particular financial structure

dominates another if, ceteris paribus, it increases total firm value or reduces the entrant payoff from merger. It follows that $B > B_H$ is dominated by B_H since the former policy induces no mergers while the latter induces a merger iff $y = y_l$, with the entrant receiving only his reservation value $\overline{\pi}_2 + y_l$. Face values $B \in (B_L, B_H)$ are dominated by B_H since both stances induce mergers iff $y = y_l$, with the latter policy minimizing the entrant's payoff from merger. Finally, B_L dominates $B \in [0, B_L)$ since both policies always induce mergers, with the former minimizing the entrant's payoff.

1.4. Optimal Venture Capital Contract

Continuing the backward induction, we next analyze the venture capital contract. Since the cash flows of the entrant are not observable, the contract must be based upon a verifiable cash flow report made by m. The venture capital contract consists of a pair of functions (r, β) mapping the manager's first-stage cash flow report, denoted $\widehat{\pi}_1$, to reimbursements to vc and ownership probabilities for m, respectively.

In order to derive the optimal contract it is necessary to compute the expected value m and vc attach to winning ownership of firm e, with the expectation taken at date t_0. Before doing so we recall that ownership of firm e is decided at time t_1^+, after the first period cash flow report and before y is observed. The manager's valuation is denoted x and the venture capitalist's valuation is denoted p, with subscripts indexing the incumbent's debt.

Under $B = B_H$ there is no merger if $y = y_h$, with merger negotiations pinning the entrant owner to the reservation value of $\overline{\pi}_2 + y_l$ if y_l is realized. Therefore, here the expected value to m from winning ownership of firm e is his expected reservation value

$$x_H = \overline{\pi}_2 + \theta y_h + (1 - \theta) y_l. \tag{16}$$

Similarly, if $B = B_H$ the vc values ownership rights at his reservation value

$$p_H = \overline{\pi}_2 + y_l. \tag{17}$$

Under $B = B_L$ merger always occurs. If $y = y_h$ merger negotiations pin m to her reservation

value of $\overline{\pi}_2 + y_h$. If y_l is realized, the entrant will capture the value given by equation (12). It follows that

$$x_L = \overline{\pi}_2 + \theta y_h + (1-\theta)\left[y_l + \frac{1}{2}(Y - y_l) + \eta\right] > x_H. \tag{18}$$

$$p_L = \overline{\pi}_2 + y_l + \frac{1}{2}(Y - y_l) + \eta > p_H. \tag{19}$$

Having determined the ex ante value of ownership rights, we can express the optimal contract in terms of the pair (p, x). Before doing so we adopt a final technical assumption that greatly simplifies the algebra involved without altering anything of economic substance.

$$A4 : \overline{\pi}_2 + \theta y_h + (1-\theta) y_l \geq \pi_1^{\max}.$$

The optimal contract maximizes the gross return to vc which consists of first-stage cash reimbursements r plus the value of his ownership rights. Limited liability (LL) demands $r(\pi_1) \leq \pi_1$ at each point on the state-space $[0, \pi_1^{\max}]$. From the revelation principle it follows that attention can be confined to contracts eliciting truthful reporting of first-stage cash flow. The global incentive compatibility (IC) condition is

$$x\beta(\pi) - r(\pi) \geq x\beta(\widetilde{\pi}) - r(\widetilde{\pi}) \quad \forall \quad (\pi, \widetilde{\pi}) \in [0, \pi_1^{\max}] \times [0, \pi_1^{\max}]. \tag{20}$$

This condition is satisfied with equality at all points on the state space when $r' = x\beta'$.

The IC condition is informative about the trade-offs facing the financier in choosing β. By increasing β marginally, the value of the financier's ownership rights fall by $p\beta'$. However, there is a larger compensating gain since m is willing to increase the reimbursement by $x\beta'$.

The optimal contract solves

$$\max_{r,\beta} \quad v \equiv \int_0^{\pi_1^{\max}} [r(\pi) + (1 - \beta(\pi))p] f(\pi)\, d\pi \tag{21}$$

subject to

$$LL : r(\pi) \leq \pi$$

$$IC : r'(\pi) = x\beta'(\pi)$$

$$\beta(\pi) \in [0, 1].$$

Lemma 2 characterizes the optimal contract.

Lemma 2. *The optimal venture capital contract is*

$$\beta(\widehat{\pi}_1) = \frac{\widehat{\pi}_1}{x} \tag{22}$$

$$r(\widehat{\pi}_1) = \widehat{\pi}_1.$$

The gross return to the venture capitalist under the optimal contract is

$$v^* \equiv \overline{\pi}_1 + \left[1 - \frac{\overline{\pi}_1}{x}\right] p. \tag{23}$$

Proof: See appendix.

Lemma 2 indicates that the optimal venture capital contract calls for vc to receive all first-stage cash flows, with m being encouraged to deliver higher cash flows using the promise of increased ownership rights. The gross return to vc is then simply the expected first-stage cash flow plus the expected value of his ownership claim. Since entry only occurs if $k \leq v^*$, it follows that the incumbent increases the probability of entry by choosing B_L rather than B_H. To see this note that

$$v_L^* = \overline{\pi}_1 + \left[1 - \frac{\overline{\pi}_1}{x_L}\right] p_L > v_H^* = \overline{\pi}_1 + \left[1 - \frac{\overline{\pi}_1}{x_H}\right] p_H. \tag{24}$$

It is interesting to note that the adoption of B_L relaxes the entrant's financing constraint through two channels. First, the venture capitalist's return is directly increased by the fact that he places higher value on ownership rights with $p_L > p_H$. Second, the incentive compatibility condition is relaxed, with the manager being more willing to deliver first-stage project returns in exchange for increased ownership rights since $x_L > x_H$.

1.5. Optimal Long-Term Debt for Incumbent

Having determined the optimal response of the entrant to the leverage chosen by the incumbent, the last step in the backward induction is to determine B^*. To this end, let V_L and V_H denote the date t_{-1} cum-dividend value of manager M's claim to cash flows and control benefits according to whether he chooses B_L or B_H, respectively.

Suppose first B_L is chosen. Then entry occurs with probability $Z(v_L^*)$. If there is no entry, the incumbent captures the monopoly cash flow in both periods plus the control benefit Y. If there is entry, the incumbent only receives the duopoly cash flow in the first period. However, when B_L is chosen the entrant and incumbent always merge in the second period. The incumbent's payoff in the event of the merger is total firm value, including control benefits, less the value captured by the entrant. The value captured by the entrant depends on the realized control benefit y. If $y = y_h$, there is zero residual surplus from merger and the entrant is pinned to the reservation value of $\overline{\pi}_2 + y_h$. When $y = y_l$, there is residual merger surplus, and the entrant captures the amount derived in equation (12). Therefore,

$$\begin{aligned} V_L &= [1 - Z(v_L^*)][\overline{\Pi}_1^m + \overline{\Pi}_2^m + Y] + Z(v_L^*)\overline{\Pi}_1^d \\ &\quad + Z(v_L^*)\left[1 - \frac{\overline{\pi}_1\theta}{x_L}\right]\left[\overline{\Pi}_2^m + \frac{1}{2}(Y - y_l) - \overline{\pi}_2 - \eta\right] \\ &\quad + Z(v_L^*)\left[\frac{\overline{\pi}_1\theta}{x_L}\right]\left[\overline{\Pi}_2^m - \overline{\pi}_2\right]. \end{aligned} \tag{25}$$

Suppose next that B_H is chosen. Then entry only occurs with probability $Z(v_H^*) < Z(v_L^*)$. If there is entry, the incumbent receives the duopoly cash flow in the first period. Post-entry, the incumbent and entrant merge iff $y = y_l$. In such a merger, there is zero residual surplus and the entrant is pinned to the reservation value $\overline{\pi}_2 + y_l$. Therefore,

$$\begin{aligned} V_H &= [1 - Z(v_H^*)][\overline{\Pi}_1^m + \overline{\Pi}_2^m + Y] + Z(v_H^*)\overline{\Pi}_1^d \\ &\quad + Z(v_H^*)\left[1 - \frac{\overline{\pi}_1\theta}{x_H}\right]\left[\overline{\Pi}_2^m + Y - \overline{\pi}_2 - y_l\right] \\ &\quad + Z(v_H^*)\left[\frac{\overline{\pi}_1\theta}{x_H}\right]\left[\overline{\Pi}_2^d + Y\right]. \end{aligned} \tag{26}$$

A bit of algebra yields Proposition 1.

Proposition 1. *The optimal long-term debt for the incumbent is $B_H > B_L$ if*

$$\frac{Z(v_H^*)}{Z(v_L^*)} \leq \frac{[\overline{\Pi}_1^m - \overline{\Pi}_1^d] + \left[1 - \frac{\overline{\pi}_1\theta}{x_L}\right][\overline{\pi}_2 + y_l + \frac{1}{2}(Y - y_l) + \eta] + \left[\frac{\overline{\pi}_1\theta}{x_L}\right][Y + \overline{\pi}_2]}{[\overline{\Pi}_1^m - \overline{\Pi}_1^d] + \left[1 - \frac{\overline{\pi}_1\theta}{x_H}\right][\overline{\pi}_2 + y_l] + \left[\frac{\overline{\pi}_1\theta}{x_H}\right][\overline{\Pi}_2^m - \overline{\Pi}_2^d]} \tag{27}$$

and $B_L > 0$ if not.

Corollary. *The attractiveness of high debt increases in short-term monopoly rents and decreases in long-term monopoly rents. If the probability of high control benefits is sufficiently low, then B_H is optimal.*

The intuition for Proposition 1 and its corollary are as follows. Effectively, the proposition states that high debt is optimal when the entry deterrence effect, captured by the left side of equation (27), is sufficiently strong. The first bracketed terms in the numerator and dominator of the right side of the equation capture the likelihood that entry will be deterred and that the monopoly profit will be captured in the first period. Since $Z(v_H^*) < Z(v_L^*)$, the first-stage monopoly rent is more valuable if the incumbent has high debt. Thus, a testable implication of the model is that value firms should have higher leverage. The middle terms in the numerator and denominator measure the expected premium that must be paid to the entrant in the event that low control benefits are realized and the entrant is acquired. These terms capture the second benefit of high debt, potential reductions in acquisition premia. The last bracketed terms capture the cost of high debt, the loss of second-stage monopoly rents if high debt overhang prevents a merger from taking place when control benefits are high. Thus, another testable implication of the model is that growth firms should eschew long-term debt. Further, the model predicts that leverage should be decreasing in total expected control benefits.

2. Model Extensions

This section considers various extensions of the model and alternative assumptions.

2.1. Covenants Restricting Mergers and Acquisitions

Bond covenants routinely place various restrictions on firms' ability to engage in mergers and acquisitions. Typically, such covenants are justified as devices for mitigating agency problems, e.g. potential risk shifting associated with a risky acquisition. Here we show that such covenants can play an important role in determining the division of surplus in asset sales. We consider the following simple covenant. The incumbent can include in his debt a covenant prohibiting a merger if entrant

debt exceeds $b^{\max}$. Similarly, the entrant can include in her debt a covenant prohibiting a merger if incumbent debt exceeds $B^{\max}$.

What is the equilibrium of the resulting Stackelberg game in bond covenants? Using backward induction we first analyze the optimal entrant covenant. If a merger occurs, the entrant cannot receive less than the value of her outside option, which is $\overline{\pi}_2 + y$. Therefore, as the follower, the entrant will simply "accommodate" the debt chosen by the incumbent by failing to write any such covenant or by stipulating $B^{\max}$ greater than the B actually chosen by the incumbent.

Again, without loss of generality we may confine attention to $B \in \{B_L, B_H\}$. When B_H is chosen by the incumbent, the entrant will choose $b^* = 0$, implying that any covenant stipulating $b^{\max}$ would be redundant in this case. However, if B_L is chosen by the incumbent and control benefits are low, the entrant would choose $b_l^*(B_L) > 0$ in the absence of such a covenant. Since the entrant payoff is increasing in b, the optimal debt covenant for the incumbent would stipulate $b^{\max} = 0$. With such a covenant, all valuations presented in Section 1 would remain correct provided that one sets $\eta = 0$. Returning to equation (12) we see that η measures the extra surplus the entrant is able to capture when she issues debt against residual surplus left free by the incumbent. An optimal incumbent covenant fully limits the entrant's ability to issue debt against the surplus generated by the merger.

The following proposition summarizes the results.

Proposition 2. *Any long-term debt obligation of the entrant would not restrict B. The long-term debt of the incumbent contains a covenant stipulating $b^{\max} = 0$. In equilibrium the entrant does not issue long-term debt. The condition determining B^* is the same as that stipulated in Proposition 1 with η set equal to zero.*

Note that a covenant setting a limit on the assumption of debt only serves to increase V_L. This is because choosing B_L leaves the incumbent vulnerable to surplus extraction by the entrant as the latter dilutes the value of incumbent debt. The bond covenant prevents this activity and makes low debt relatively more attractive.

Proposition 2 provides a number of strong testable implications. First, incumbent firms should

have high long-term debt, while entrants should have low long-term debt. Second, incumbent firms should write tight debt covenants, while entrants should write covenant-lite loans, at least with respect to limitations on mergers.

2.2. Delaying Incumbent Debt Issuance until after the Entry Decision

In the model presented in Section 1, the incumbent could only issue debt at date t_{-1}. This assumption can be rationalized by lags in the flotation of public debt as the firm goes through the underwriting process with an investment bank and complies with SEC disclosure requirements. However, this timing assumption can be relaxed somewhat without changing the results stated above. In particular, Propositions 1 and 2 remain valid if the incumbent must choose its debt before knowing the realized control benefit y and before knowing the outcome of the control contest between the entrant manager and the venture capitalist.

To fix ideas, we consider the general setting of the preceding subsection, where restrictions on the assumption of counterparty debt are feasible. Now suppose that the incumbent has the option to issue date at date t_{-1} or to delay the debt flotation until after observing the entry decision of firm e. Let us then consider pairs of potentially optimal debt policies, undertaken at date t_{-1} or date t_1. Such pairs are denoted $(B^*(t_{-1}), B^*(t_1))$. Since the firm delaying debt issuance until date t_1 necessarily ignores the entry-deterrence benefit of high debt, such a firm issues weakly lower debt.[2] Therefore, we know

$$(B^*(t_{-1}), B^*(t_1)) \in \{(B_H, B_H), (B_L, B_L), (B_H, B_L)\}. \tag{28}$$

If (B_H, B_H) or (B_L, B_L) are optimal, the incumbent is indifferent between issuing debt at date t_{-1} or date t_1. However, if the pair (B_H, B_L) is optimal, then it is optimal to issue debt with face value B_H at time t_{-1}. The reasoning is as follows. If (B_H, B_L) are optimal ex ante and ex post, respectively, we know $V_H > V_L$. Issuing debt with face value of B_H at date t_{-1} allows the incumbent to attain V_H. However, if the incumbent delays issuance of debt until date t_1, the entrant

[2] Formally, it can be shown that if high debt is optimal post-entry, the ratio condition in Proposition 1 is satisfied.

will rationally infer that the incumbent will choose B_L at that time. In this case, the ex ante value of the incumbent's claim is $V_L < V_H$. We have established the following lemma.

Lemma 3. *For the incumbent, issuing debt at date t_{-1} weakly dominates issuing debt at date t_1.*

2.3. Conditioning Incumbent Debt on Entrant Control

In reality, control rights are not binary. Further, the exact date of the settlement of control contests is often unclear. Therefore it may be appropriate to assume, as we have up until this point, that the incumbent does not have the ability to condition his debt upon entrant control at date t_1^+.

This subsection considers an alternative setting in which the incumbent enjoys the option to issue debt at $t \in \{t_{-1}, t_1^+\}$. If debt is issued at date t_1^+, the incumbent observes the outcome of the control contest between vc and m. To fix ideas we maintain the feasibility of covenants limiting counterparty debt in mergers, although this assumption is not critical. The subscript w is now used to denote payoffs under the incumbent strategy of waiting to issue debt until date t_1^+.

If debt is issued at date t_{-1}, Proposition 2 characterizes the optimal debt policy. Next, consider the optimal debt policy if the incumbent delays debt issuance until t_1^+. If vc wins control, the incumbent knows control benefits are y_l. Given this knowledge, B_H is optimal since the merger will occur with probability one, with the acquisition price equal to the minimum possible, $\overline{\pi}_2 + y_l$. Suppose next that the manager wins control. If B_L is chosen, the merger occurs regardless of the realized control benefit. However, the manager will capture half the residual surplus left by the incumbent in the event that realized control benefits are low. Conversely, if B_H is chosen, no merger will occur if control benefits are high. Face value B_L is an optimal response to managerial control if it yields higher expected firm value net of entrant payoffs. Thus, B_L is an optimal response to manager control iff:

$$\begin{aligned} & \theta[\overline{\Pi}_2^m + y_h - (\overline{\pi}_2 + y_h)] + (1-\theta)\left[\overline{\Pi}_2^m + Y - \left(\overline{\pi}_2 + y_l + \frac{1}{2}(Y - y_l)\right)\right] \qquad (29) \\ \geq \quad & \theta[\overline{\Pi}_2^d + Y] + (1-\theta)\left[\overline{\Pi}_2^m + Y - (\overline{\pi}_2 + y_l)\right]. \end{aligned}$$

Rearranging terms in the preceding equation it follows that B_L is an ex post optimal response to manager control iff:

$$\frac{Y - y_l}{\overline{\Pi}_2^m - \overline{\Pi}_2^d - \overline{\pi}_2 - y_l} < \frac{2\theta}{1+\theta} \tag{30}$$

$$\Updownarrow \tag{31}$$

$$\theta > \widehat{\theta} \equiv \frac{Y - y_l}{Y - y_l + 2\left[\overline{\Pi}_2^m - \overline{\Pi}_2^d - \overline{\pi}_2 - Y\right]} \in (0,1).$$

If $\theta \leq \widehat{\theta}$, the incumbent is primarily concerned with the extraction of surplus from mergers in which the manager has low control benefits. Therefore, for low values of θ, B_H is always optimal at time t_1^+. In such cases, $V_w = V_H$ and one may assume without loss of generality that the incumbent returns to choosing between B_H and B_L at date t_{-1}. In such cases, the optimal debt policy continues to be that described in Proposition 2.

Consider next $\theta > \widehat{\theta}$. Here the incumbent would adopt a state-contingent debt policy if it were to delay its debt issuance until date t_1^+, choosing B_H in response to venture capitalist control and B_L in response to managerial control. In this case it is clear that $V_w > V_L$. This is because both policies ensure that mergers occur with probability one. However, setting B_L at time t_{-1} allows the entrant to capture a higher payoff under vc control. Therefore, to determine the optimal policy we may confine attention to a comparison of V_H and V_w.

We turn next to computing V_w for $\theta > \widehat{\theta}$. If vc has control $B = B_H$, implying

$$p_w = p_H. \tag{32}$$

If m has control $B = B_L$, implying

$$x_w = x_L > x_H. \tag{33}$$

It follows that

$$v_H^* < v_w^* < v_L^*. \tag{34}$$

Since $v_H^* < v_w^*$ it follows that delaying debt issuance has a cost in that it induces a higher probability of entry than under an ex ante commitment to B_H. There is a countervailing benefit from delayed

debt issuance, however, since it ensures that mergers occur with probability one. Computing V_w as total firm value net of entrant payoffs, one obtains

$$\begin{aligned} V_w &= [1 - Z(v_w^*)][\overline{\Pi}_1^m + \overline{\Pi}_2^m + Y] + Z(v_w^*)\overline{\Pi}_1^d \\ &\quad + Z(v_w^*)\left[1 - \frac{\overline{\pi}_1}{x_w}\right]\left[\overline{\Pi}_2^m + Y - (\overline{\pi}_2 + y_l)\right] \\ &\quad Z(v_w^*)\left[\frac{\overline{\pi}_1}{x_w}\right][1-\theta]\left[\overline{\Pi}_2^m + Y - \left(\overline{\pi}_2 + y_l + \frac{1}{2}(Y - y_l)\right)\right] \\ &\quad + Z(v_w^*)\left[\frac{\overline{\pi}_1}{x_w}\right]\theta\left[\overline{\Pi}_2^m + y_h - (\overline{\pi}_2 + y_h)\right]. \end{aligned} \tag{35}$$

This analysis leads to Proposition 3.

Proposition 3. *If $\theta \leq \widehat{\theta}$, the incumbent weakly prefers issuing debt at date t_{-1} to delaying until date t_1^+, and B^* remains as described in Proposition 2. If $\theta > \widehat{\theta}$ and*

$$\frac{Z(v_H^*)}{Z(v_w^*)} > \frac{\overline{\Pi}_1^m - \overline{\Pi}_1^d + \overline{\pi}_2 + y_l + \left[\frac{\overline{\pi}_1}{x_w}\right][1+\theta]\frac{1}{2}[Y - y_l]}{\overline{\Pi}_1^m - \overline{\Pi}_1^d + [\overline{\pi}_2 + y_l] + \left[\frac{\overline{\pi}_1}{x_H}\right]\theta[\overline{\Pi}_2^m - \overline{\Pi}_2^d - \overline{\pi}_2 - y_l]} \tag{36}$$

then the optimal policy for the incumbent is to delay debt issuance until date t_1^+, choosing B_H in response to venture capitalist control and B_L in response to manager control. Otherwise, it is optimal to choose B_H at date t_{-1}. The long-term debt of the incumbent contains a covenant stipulating $b^{\max} = 0$. In equilibrium the entrant does not issue long-term debt.

Finally, we close our analysis of the optimal timing of incumbent debt issuance by considering the optimal incumbent strategy if he can issue debt after observing the control benefit y but before any negotiation regarding merger terms. In this case, the incumbent should issue at time t_{-1} an arbitrarily small tranche of long-term debt maturing at date t_2^+ with a tight covenant prohibiting merger with firms having any long-term debt. In this way, the incumbent would prevent the entrant from extracting any merger surplus. However, the initial debt flotation should allow the incumbent to freely issue his own debt at the future date when y will be observed. The incumbent could then ensure that mergers occur with probability one, while extracting all merger surplus, by issuing new debt such that the total face value of debt is B_L if y_h is observed and B_H if y_l is observed.

3. Empirical Implications

The main argument in this paper is that the leverage and covenants of an incumbent increase its share of total surplus arising from various forms of asset mergers. In addition to this direct benefit, high incumbent debt is also predicted to limit the debt capacity of potential competitors by driving down the value of their underlying assets. Our model also delivers specific predictions regarding debt maturity and covenant structures. Mature firms are predicted to have high long-term debt and to write covenants limiting merger activity. Young entrants are predicted to have low long-term debt and to write loose covenants in terms of merger restrictions.

The first testable implication of the model is that deep-pocketed firms will pay more for acquisitions. Lang, Stulz and Walkling (1991) find that bidder returns are negatively related to bidder cash flow. Schlingemann (2004) documents the same negative correlation between cash flow and bidder gains. Servaes (1991) documents significantly negative announcement returns when an acquisition is financed with equity rather than cash (or cash raised via debt flotation). More generally, the surplus extraction channel in our model offers a rationale for why debt is a primary method of financing acquisitions. Of course, this is not the only explanation for debt financing in acquisitions.

Second, existing research supports the prediction of the model that financiers can expect higher exit prices when incumbents have low debt. Acharya, Bharath and Srinivasan (2006) find that recovery ratios on defaulted debt are lower in heavily levered industries. They also document that this effect is more pronounced for concentrated industries, highlighting the role of imperfect competition central to our model. Empirical work also shows that industry-wide distress appears to simultaneously reduce liquidation prices and increase the odds of piecemeal liquidation or sales to buyers outside the industry (e.g. Pulvino, 1998; Eckbo and Thorburn, 2007).

A third testable implication of the model is that a firm's cost of debt capital will be increasing in the leverage of *other firms*. By way of contrast, the conventional wisdom regarding the value of deep pockets would predict the exact opposite. Consistent with our model, Newman and Rierson (2004) examine spillovers in European telecom bond markets. They find that a new bond flotation

by a given telecom firm generally has a statistically and economically significant *positive* effect on the yield spread on the debt of other borrowers. This is consistent with the causal mechanism in our model, which relies upon the notion that incumbent debt has an adverse effect on the ability of entrants to get financing.

Consider next the evidence on firms' choice of debt levels and debt composition. Consistent with our model, Barclay and Smith (1995) document that larger mature firms rely more heavily upon long-term debt. Houston and James (1996) and Faulkender and Petersen (2006) document that older firms have higher leverage ratios and are more likely to use public debt as opposed to bank or privately placed debt. This is consistent with our argument that public debt can be used as a commitment device for firms seeking to protect economic rents.

Rajan and Zingales (1995) document that value firms choose higher debt levels than growth firms. Such evidence is typically interpreted as being supportive of the theory of Myers (1977), who argues that growth firms want to avoid debt. Our model generates a similar prediction, with Corollary 1 stating that high leverage is less attractive when the long-term monopoly rent is important. However, Myers' theory fails to explain why value firms take on debt. In his framework, the optimal debt for all firms is zero. By way of contrast, our model provides a rationale for the use of public debt by value firms, with Proposition 1 predicting that value firms will take on debt in order to protect short-term rents.

Consistent with our theory, MacKay and Phillips (2005) find that leverage ratios are higher in concentrated industries. In addition, they find that profitability and (high) leverage for incumbent firms are both highly persistent. This is consistent with our argument that the high debt burdens of incumbents serve to alleviate the competitive pressures that would otherwise dissipate economic rents.

The most important untested implications of our theory concern the structure of bond covenants. The theory offered here suggests that mature firms should write tight covenants limiting the assumption of debt in mergers, with younger firms writing loose covenants. A recent survey documents

that change of control covenants were attached to more than half of European public debt issues.[3] However, there is no direct evidence relating event risk covenants to firm characteristics. Consistent with our theory, change of control covenants do appear to generate a positive spillover to lenders in the event of merger. Billett, Jiang, and Lie (2008) document that bondholders without covenant protection experience a negative abnormal return in LBOs while those with protection experience positive abnormal returns.

Bae, Klein and Padmaraj (1994) find that the inclusion of event risk covenants in a bond flotation has a positive effect on the abnormal return to shareholders, consistent with our model. However, the evidence on this issue is mixed. An alternative hypothesis is that event risk covenants are used as a device for increasing managerial entrenchment, to the detriment of shareholders. Consistent with that hypothesis, Norton and Pettengill (1998) document that event risk covenants have a negative effect on shareholder returns. Further testing of this hypothesis, linked to variables measuring the quality of corporate governance would be helpful in clarifying the conflicting empirical evidence.

3. Conclusion

There is no denying the value conferred upon an incumbent with deep pockets. In this paper, we showed that maintaining deep pockets has a countervailing cost. When facing a deep-pocketed incumbent, a potential entrant knows that the incumbent has the incentive to engage in value enhancing asset mergers ex post. In some cases, this positive effect on exit values may be sufficient to tilt the balance in favor of entry. The existence of such an effect was illustrated using a simple contracting model with endogenous price determination in secondary asset merger markets. Zero debt is never optimal for the incumbent. Rather, he should at least create a minimal level of debt overhang so that all bilateral merger surplus is exhausted when total surplus is low. By taking on even higher levels of debt, the incumbent increases his ability to extract additional surplus when the latter is high. However, this comes at the cost of an increased probability of failed merger if total surplus is low. Finally, in terms of incumbent financial structure, it was shown that event risk

[3] See Steve Rothwell, Poison puts win lower rates for Rentokil, M&S amid LBO threats, Bloomberg.com.

covenants, such as poison puts for bondholders, can be value increasing for incumbent shareholders since they limit entrants' ability to access merger surplus.

It was also shown that a financially inflexible incumbent will have a significant effect on the shape of venture capital contracts. In particular, the debt and/or covenants of an incumbent prevent entrants from utilizing long-term debt financing and limit overall debt capacity. This effect operates through two distinct channels. First, shallow incumbent pockets reduce the value financiers receive in the event of asset sales. Second, shallow incumbent pockets reduce the value the entrant manager places on retaining ownership. This weakens the power of feasible incentives.

The more general message delivered by the model is that the overhang problem, first discussed by Myers (1977), is not isolated to the particular firm operating under a high debt burden. Rather, the high debt of an incumbent will tend to discourage entry and entrepreneurial activity in its sector. This is because the sell price of capital, typically treated as an exogenous parameter in investment models, is an endogenous variable that is decreasing in the leverage of existing firms. Our model shows that such overhang may confer a benefit to incumbents, allowing them to capture economic rents. However, such strategic behavior is clearly detrimental to product market competition, economic efficiency, and innovation.

APPENDIX: Proof of Lemma 2

There are two state variables for the control problem, r and β. The control is $\xi \equiv \beta'$. The Lagrangian for the control problem is

$$\begin{aligned} \Lambda \equiv\ & f(\pi)[r(\pi) + p(1-\beta(\pi))] + \mu_\beta(\pi)\xi(\pi) + \mu_r(\pi)x\xi(\pi) + \\ & \lambda(\pi)[\pi - r(\pi)] + \overline{m}(\pi)[1-\beta(\pi)] + \underline{m}(\pi)\beta(\pi). \end{aligned} \tag{37}$$

The optimality condition is

$$\begin{aligned} \frac{\partial \Lambda}{\partial \xi} &= \mu_\beta(\pi) + x\mu_r(\pi) = 0 \quad \forall \quad \pi \\ &\Rightarrow \quad \mu'_\beta(\pi) = -x\mu'_r(\pi) \quad \forall \quad \pi. \end{aligned} \tag{38}$$

The multiplier conditions are

$$\begin{aligned} \mu'_\beta(\pi) &= -\frac{\partial \Lambda}{\partial \beta} = pf(\pi) + \overline{m}(\pi) - \underline{m}(\pi) \quad \forall \quad \pi. \\ \mu'_r(\pi) &= -\frac{\partial \Lambda}{\partial r} = \lambda(\pi) - f(\pi) \quad \forall \quad \pi. \end{aligned} \tag{39}$$

Substituting the multiplier conditions into the differential equation implied by the optimality condition one obtains

$$x\lambda(\pi) + \overline{m}(\pi) - \underline{m}(\pi) = (x-p)f(\pi) \quad \forall \quad \pi. \tag{40}$$

The transversality condition for this problem is $\beta(0) = 0$. Next note since $x > p$ it follows that $\beta(\pi) < 1 \Rightarrow r(\pi) = \pi$ under the optimal program.■

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