

ACQUISITION VALUES AND OPTIMAL FINANCIAL (IN)FLEXIBILITY*

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We analyze optimal financial structure for an incumbent and potential entrant accounting for feedback effects in secondary asset markets. By issuing sufficient debt, the incumbent creates overhang and credibly commits against acquiring entrant assets. This depresses asset values and entrant returns, thus reducing the likelihood of entry. The cost of debt overhang is that the incumbent fails to make positive NPV acquisitions if entry deterrence fails. The implied trade-off between ex post efficiency and entry deterrence explains why growth firms eschew debt while value firms issue public debt. Contrary to the traditional view, if predation is feasible, the case for shallow pockets is potentially stronger, since an unlevered incumbent prefers to acquire whereas a levered incumbent responds to entry with predation. Since predation reduces entrant returns and acquisitions raise them, the entry deterrence benefit from shallow pockets is magnified if predation is feasible. Optimal entrant contracts depend upon incumbent financial structure, with higher debt capacity and stronger financier ownership rights if the incumbent has deep pockets.

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We analyze optimal financial structure for an incumbent and potential entrant accounting for feedback effects in secondary asset markets. By issuing sufficient debt, the incumbent creates overhang and credibly commits against acquiring entrant assets. This depresses asset values and entrant returns, thus reducing the likelihood of entry. The cost of debt overhang is that the incumbent fails to make positive NPV acquisitions if entry deterrence fails. The implied trade-off between ex post efficiency and entry deterrence explains why growth firms eschew debt while value firms issue public debt. Contrary to the traditional view, if predation is feasible, the case for shallow pockets is potentially stronger, since an unlevered incumbent prefers to acquire whereas a levered incumbent responds to entry with predation. Since predation reduces entrant returns and acquisitions raise them, the entry deterrence benefit from shallow pockets is magnified if predation is feasible. Optimal entrant contracts depend upon incumbent financial structure, with higher debt capacity and stronger financier ownership rights if the incumbent has deep pockets.

KEYWORDS: FINANCIAL FLEXIBILITY, MARKET ENTRY, ACQUISITION, EXIT VALUES, PREDATION, 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 that the incumbent will utilize financial slack to finance predatory behavior, e.g. advertising targeted against rivals. Missing in this well-known argument is the fact that an incumbent may use his financial strength not only for predation, but also for acquisition. In this paper, we show that once the acquisition option is taken into account, the deep pockets of an incumbent may actually serve to encourage entry.

Our argument is simple. The willingness of financiers to provide funding to entrants is determined in large part by expected asset prices in the event of exit. 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 the natural asset buyer. Consistent with this view, 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.” By maintaining deep pockets, an incumbent conveys to the market his ability to purchase entrant assets. This increases expected exit prices, relaxes financing constraints, and stimulates entry.

In order to deter entry, the incumbent would like to claim that it will not acquire entrants. However, such a claim is not credible (subgame perfect) for an unlevered firm. Once entry has taken place, an acquisition is a positive NPV investment for an unlevered incumbent since this allows him to recapture market power. However, by taking on sufficient debt, and exposing itself to the debt overhang effect posited by Myers (1977), the incumbent makes a credible commitment against participating in secondary asset markets. Thus, we identify a strategic rationale for corporate leverage as a device that helps reduce expected asset values and deter entry. This novel rationale for public debt is the first insight provided by the model.

We identify the following trade-off. Although debt helps to depress asset values, entry deterrence will not always succeed. For example, if entry costs are lower than expected, entry will still occur despite depressed asset values. The shallow pockets strategy is then costly, since a levered incumbent fails to acquire the successful entrant even though such an acquisition would be a positive-NPV

investment. Further, if leverage is extremely high, the incumbent will be unwilling to finance predatory attacks ex post. Ex post inefficiency is the dark side of debt overhang. We show that the shallow pockets strategy dominates deep pockets only if the value gain from entry deterrence is larger than the ex ante expected value of making positive-NPV investments in response to entry. Identifying this trade-off is the second insight provided by the model.

The analysis of the strategic implications of shallow pockets leads us to a reappraisal of the relationship between predation and financial flexibility. This is the third novel insight of our model. The traditional view, based on Telser (1966) and Bolton and Scharfstein (1990), argues that maintaining a deep pocket (“long purse”) is especially attractive if the incumbent has the ability to prey on entrants, since financial slack is necessary to fund predatory activities. We show that the traditional view does not hold if the incumbent also enjoys the option to acquire entrants. The reasoning is simple. If entry occurs, an unlevered incumbent will generally opt for an acquisition since this is the efficient response and is sure to eliminate the competitor from the market. Predation on the other hand is inherently uncertain, as argued by Telser (1966) and Bolton and Scharfstein (1990). However, with a sufficiently high level of debt, the incumbent’s preferences are tilted towards less costly investments in predatory activities, despite their having a chance of failing. From an ex ante perspective, it can be optimal to adopt a levered financial structure that renders predation incentive compatible ex post, since predation discourages entry whereas acquisitions encourage entry.

The optimal entrant financial contract depends on incumbent capital structure, but the nature of this relationship is the opposite of the traditional view (e.g. Bolton and Scharfstein, 1990), with shallow rather than deep pockets limiting financier returns and the power of incentives. Our fourth insight is to highlight this effect. In our model, the entrant manager must rely upon outside financing and project returns are privately observed. The incentive contract uses ownership rights as a carrot to induce the manager to disgorge some portion of first-stage returns to the financier. In this setting, the deep pockets of an incumbent relax the financing constraint through two distinct channels. First, if the incentive contract calls for the manager to forfeit ownership, the financier

receives a higher price in his asset auction if the incumbent has deep pockets. The second channel is more subtle. If the incumbent has deep pockets, the manager places a high value on retaining ownership – since there is a high valuation buyer in the market for the entrant’s assets. This sweetening of the carrot increases managerial incentives and allows the financier to extract all first-stage profit while retaining stronger ownership rights for himself. Both effects raise the financier’s return, increasing the likelihood of project funding.

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. The assumptions of Bolton and Scharfstein are appropriate in settings where regulators prohibit acquisitions. However, the empirical evidence cited above suggests that incumbents frequently acquire entrants. Further, in the U.S., regulators are often willing to waive antitrust objections for firms in financial distress.

Our paper is naturally related to Myers (1977) since all effects of leverage stem from the presence or absence of debt overhang. An important contribution of Myers’ model is that it helps to explain why growth firms avoid debt. It fails, however, to explain why any 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 a benefit of debt overhang linked to entry deterrence. As we show, this benefit is particularly large for value firms. This novel explanation for the use of public debt is also robust to Zwiebel’s (1996) critique of agency-based theories and Miller’s (1977) critique of tax-based theories.

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 committing itself against acquiring entrants' assets in bankruptcy auctions and trade sales. In the interest of logical clarity, our model deliberately rules out any direct effect of leverage on price or quantity decisions.

The remainder of the paper is as follows. Section 1 describes the product market and derives equilibrium asset prices. Section 2 derives the optimal entrant contract. Section 3 identifies conditions under which shallow pockets is an optimal strategy for the incumbent in a setting with no predation. Section 4 extends the baseline model by allowing the incumbent to choose between predation and acquisition in response to entry. Section 5 allows the incumbent to engage in predation and acquisition sequentially. Section 6 discusses empirical evidence. Section 7 concludes.

1. The Model

This section begins by describing the product market. We then move on to a discussion of price determination in the secondary market for the entrant's assets.

1.1. *Timing and Payoffs*

Figure 1 provides a time-line of events in the baseline model. We follow Bolton and Scharfstein (1990) in assuming the incumbent firm A has a long purse. In particular, the sole owner-manager of firm A has sufficient personal wealth to fund any investments he may want his firm to undertake.¹ Firm A is currently unlevered. At time t_{-1} , firm A has the ability to engage in an observable leveraged recapitalization. In the contemplated recapitalization, the proceeds from a debt flotation would be distributed as a dividend.² Following Hart (1991) and Shleifer and Vishny (1992), firm A issues debt that is not renegotiable. Confining attention to non-renegotiable debt is without loss of generality, since only non-renegotiable debt has commitment value for the incumbent.

In reality, public debt issued to dispersed creditors best approximates the type of security we have in mind. As argued by Smith and Warner (1979), the strictures of the Trust Indenture Act

¹Equivalently, we may assume A enjoys frictionless access to external equity.

²In fact, the firm with debt would optimally pay out any earnings and cash as dividends. There is no precautionary motive for retentions since the owner-manager has a long purse.

monopoly. If the incumbent enjoys a monopoly in the second-stage, profits Π_2^m have p.d.f. g and c.d.f. G . If the incumbent faces competition in the second-stage, profits Π_2^d have p.d.f. h and c.d.f. H . There are no atoms in the distributions G and H of second-stage profits and monopoly profits are first-order stochastic dominant with $G(\Pi_2) < H(\Pi_2)$ for all $\Pi_2 \in (\Pi_L, \Pi_H)$. Let $\Delta\bar{\Pi}_j \equiv \bar{\Pi}_j^m - \bar{\Pi}_j^d$ denote the expected monopoly rent in period t_j .

Since firm B is the only potential entrant, the incumbent will enjoy a monopoly in both periods if $M1$ does not enter at time t_0 . If $M1$ does enter, there will be product market competition in period t_1 and *potentially* in period t_2 . If entry occurs, the incumbent can still eliminate competition in period t_2 by acquiring the nonhuman assets of the entrant at time t_2^- . In the baseline model, the incumbent has no other means of eliminating a successful entrant in period t_2 . Section 4 extends the baseline model, allowing the incumbent to engage in predatory advertising that has the potential to eliminate a successful entrant from continuing operations in period t_2 .

The working assumption in the model is that only the nonhuman assets (e.g. physical capital, brand name, or patents) of firm B are essential for independent production in period t_2 . For example, the physical capital of an entrant is essential if there is time-to-build or if the capital occupies a central location (e.g. downtown storefront). The brand name of the entrant is necessary if reputation-building operates with a lag. The essential nature of patents is obvious. In contrast, the original manager $M1$ is only needed to get the project up and running. That is, $M1$ is essential for period t_1 but not for period t_2 . This assumption ensures the entrant's assets have value even if manager $M1$ no longer operates them. The economic motivation for the assumption is that a company's founder may have a good idea facilitating entry. However, once the firm matures, there is greater substitutability of managers. This assumption is consistent with empirical evidence presented by Hannan, Burton and Baron (1996) in a study of Silicon Valley start-ups. They document that the probability of a nonfounder CEO is 10% in the first 20 months, 40% after 40 months, and 80% after 80 months.

Entry requires a single investment i . At time t_0 , the cost i is drawn from $[0, \bar{i}]$ with p.d.f. $z(\cdot)$

and c.d.f. $Z(\cdot)$. The distribution of entry costs has no atoms and satisfies $z(i) > 0$ for all $i \in [0, \bar{i}]$. At time t_{-1} , when the incumbent makes his leverage decision, he does not know the realized value of i . Rather, he simply knows the distribution of entry costs. Entrant profits in period t_1 are π , with π distributed continuously on $[\pi_L, \pi_H]$, where $\pi_L \geq 0$, following a strictly positive and atomless probability density function f . In period t_2 , if manager $M1$ operates the assets on her own, she earns a privately observed benefit of y which encompasses expected profits and private benefits of control. We follow Bolton and Scharfstein (1990) in assuming the entry investment always has positive expected net present value with

$$A1 : \bar{\pi} + y \geq \bar{i} .$$

Under assumption $A1$, manager $M1$ would always enter the market if she could finance entry out of her own funds.

Since $M1$ has no wealth, she must turn to an outside financier. Limiting her ability to raise funds is the fact that realized profits are her private information. Therefore, rewards and punishments of $M1$ can only be made contingent upon her voluntary profit report. The financial contract between the financier and manager is written at time t_0 when the entry cost i is observed. The framework for financial contracting between $M1$ and the financier follows those presented in Faure-Grimaud (2000) and Povel and Raith (2004). The space of legally enforceable contracts consists of a reimbursement schedule r that $M1$ pays to the financier from the t_1 -profit and a reward probability b . The reward b is the probability of $M1$ winning ownership of the firm at time t_1^+ in an “ownership lottery.” The set of contracts is not limited to deterministic schemes: the fact that the reward for $M1$ 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.

Our model of the contracting problem for the entrant differs in two respects from Faure-Grimaud (2000) and Povel and Raith (2004). First, the exit payoffs are endogenous and depend upon the financial structure of the incumbent. Second, we follow Bolton and Scharfstein (1990) in assuming

the financier holds all bargaining power at time t_0 . This is without loss of generality since we are interested in identifying conditions under which $M1$ will be able to raise the necessary funds. The maximum funding possible is that which obtains when the financier has all bargaining power.

The conjunction of privately observed cash flows and the entrant's need for outside finance are both integral to our analysis. To see this, recall that entry would always take place under assumption $A1$ if the entrant could self-finance or credibly deliver all project returns to the financier. Anticipating, the incumbent chooses his financial posture to take advantage of the entrant's need for outside finance.

1.2. Secondary Asset Markets and the Incumbent's Financial Structure

Just prior to the second period of potential product market competition (t_2^-), the entrant's assets can be sold to three potential bidders: firm A , manager 2 ($M2$)³, and a liquidation specialist. Following Shleifer and Vishny (1992), we assume the financier cannot operate the assets himself. If he wins the ownership lottery, he must sell the assets using an ascending-bid auction. In this auction, the behavior of the bidder with the highest fundamental value (the incumbent) has a direct impact since prices are higher when he bids. Other standard auction formats lead to comparable predictions. Let p denote the value the financier attaches to ownership rights, evaluated at the time the financial contract is signed (t_0). In the baseline model, which rules out predation, p is equal to the price fetched for the assets if the financier conducts an auction.

The liquidation specialist values the assets at $\ell > 0$. Manager $M2$ values the assets at αy , which can be viewed as the sum of expected profits plus private benefits of control. In the interest of generality, the baseline model considers the possibility that $M1$ values the assets more highly than $M2$ ($\alpha < 1$) as well as the possibility that $M2$ values the assets more highly than $M1$ ($\alpha \geq 1$). An unlevered incumbent values the assets at the monopoly rent $\Delta \bar{\Pi}_2$. All valuations are public

³Manager 2 operates the assets independently and is capable of self-financing any acquisition.

information. We assume

$$A2 : \bar{\Pi}_2^m - \bar{\Pi}_2^d > y \max\{\alpha, 1\} \geq y \min\{\alpha, 1\} > \ell > 0.$$

$$A3 : \pi_H \leq \ell.$$

Assumption A2 states that industry profits are highest in period t_2 when the incumbent maintains a monopoly. Further, the value to $M1$ and $M2$ of running firm B in period t_2 exceeds the liquidation value. Assumption A3 implies that $M1$ is financially constrained at time t_2^- . In particular, $M1$ does not have sufficient wealth to buy back the assets of the firm on secondary markets if the financier seizes them.⁴ Intuitively, the profits generated by a start-up are likely to be low relative to the value of underlying assets. Assumption A3 is also useful from a technical perspective ensuring there are no feedback effects from $M1$'s compensation to asset prices.

If the financier seizes the firm's assets, which depends on the outcome of the ownership lottery, the sales price depends upon A 's financial structure. This is because debt overhang affects willingness-to-pay. In particular, if the incumbent issues risky debt, lenders capture some of the gain from an acquisition since the shift from duopoly to monopoly reduces the probability of default. This leakage of surplus from an acquisition reduces levered equity's willingness-to-pay. Anticipating, in our baseline model attention can be confined to two financial strategies of the incumbent: deep pockets and shallow pockets. Under the deep pockets strategy, the incumbent remains unlevered and faces no debt overhang. Under the shallow pockets strategy, the incumbent uses the debt overhang created by a long-term public debt obligation in order to pre-commit to a maximum bid of ℓ .⁵ This ensures the incumbent has no effect on the price of assets in secondary markets.

Under the stated assumptions, if entry occurs, an acquisition at time t_2^- is always a positive NPV investment to unlevered equity. It follows that if the financier conducts an asset auction, the unlevered incumbent will be the highest bidder and will acquire the assets for αy . The NPV of this acquisition is $\Delta \bar{\Pi}_2 - \alpha y > 0$.

⁴Note also that $M1$ cannot gain the backing of another financier since y is nonverifiable in a court.

⁵Short-term debt coming due in period t_1 would have no effect since it matures before the acquisition decision. See Myers (1977) for a discussion.

Long-term debt is due at the end of period t_2 and its face value is denoted D . In order to protect lenders against dilution, the debt covenant prohibits the flotation of any additional debt. Smith and Warner (1979) document that the issuance of additional debt is commonly restricted by debt covenants.

The function β measures levered equity's maximum willingness-to-pay (WTP) for entrant assets. Since acquisition shifts the competitive structure of the industry from duopoly to monopoly, we have

$$\beta(D) \equiv \int_D^{\Pi_H} (\Pi - D)[g(\Pi) - h(\Pi)]d\Pi. \quad (1)$$

If the debt obligation is safe, the incumbent's willingness-to-pay remains equal to the full monopoly rent, with

$$D \in [0, \Pi_L] \Rightarrow \beta(D) = \Delta \bar{\Pi}_2^m. \quad (2)$$

Further, we know that $\beta(\Pi_H) = 0$. From Leibniz' rule and the first-order stochastic dominance relation between G and H it follows that β is strictly decreasing on (Π_L, Π_H) . Thus, there exists a unique debt commitment, call it $D(\ell)$, solving

$$\beta[D(\ell)] = \ell \Rightarrow D(\ell) = \beta^{-1}(\ell). \quad (3)$$

The incumbent can commit to a maximum bid of ℓ using any long-term debt commitment with $D \geq \beta^{-1}(\ell)$.

If the incumbent has shallow pockets, the financier recognizes that asset prices will be depressed, since the incumbent will not participate in the asset auction. In this case, if the financier were to hold an asset auction, $M2$ would win and pay ℓ . Recall that under the deep pockets strategy, the financier anticipates a higher auction price of $\alpha y > \ell$. These prices and outcomes are summarized in the last two columns of Table 1.

We denote by x the value $M1$ attaches to ownership rights, evaluated at the time the financial contract is signed (t_0). Recall that if $M1$ continues with independent production in t_2 , her benefit is y . Instead of running the firm herself, $M1$ can hold an asset auction (like the financier) or conduct a direct negotiated trade sale. To maintain consistency with the valuations obtained under the

ascending auction, it is assumed that the buyer holds all bargaining power in the event of a trade sale. In this way, $M1$ is always paid the value of her next best alternative regardless of the mode of asset sale.

	Manager $M1$ retains ownership		Financier seizes assets	
	Value x	Owner in t_2	Value p	Owner in t_2
Shallow: $\alpha < 1$	y	M1	ℓ	M2
Shallow: $\alpha \geq 1$	y	M2	ℓ	M2
Deep: $\alpha < 1$	y	A	αy	A
Deep: $\alpha \geq 1$	αy	A	αy	A

Table 1: Asset Valuations and Final Owners

Suppose that $M1$ has won the ownership lottery and first consider outcomes if A has deep pockets. In an auction, the assets would be sold to A at price αy . Independent production pays y , as does a direct trade sale. In this setting, if $\alpha \geq 1$ then $x = \alpha y$ with $M1$ opting to auction the assets to A . If $\alpha < 1$, then $x = y$, with $M1$ selling assets to firm A in a direct trade sale.

Suppose next that the incumbent has shallow pockets. If A does not participate, the auction price of the assets would be ℓ . We can therefore rule out $M1$ choosing the asset auction since independent production yields $y > \ell$. Consider next a direct trade sale to $M2$. If $\alpha \geq 1$, $M2$ would buy the assets in the trade sale with $M1$ receiving $x = y$. If $M2$ is less productive, with $\alpha < 1$, then $M1$ would run the firm herself and receive the benefit $x = y$. These prices and outcomes are summarized in the first two columns of Table 1.

There are a few points worthy of note in Table 1. First, note that firm A will only face product market competition at t_2 if it chooses shallow pockets. This is the strategic cost to the shallow pockets strategy. The strategic benefit to shallow pockets is that it can be expected to lower the financier's return. As shown in Table 1, the financier can anticipate higher auction prices if the incumbent has deep pockets. In addition, note that the value the manager attaches to ownership

(x) is weakly higher when the incumbent has deep pockets. Anticipating, this effect also raises the financier's return. This is because the manager is willing to deliver more first-stage cash to the financier in exchange for an increase in b .

It is also worth noting that asset seizure by the financier is generally pareto inefficient, from the perspective of $M1$ and the financier. Asset seizure is pareto inefficient when $p < x$, which is the case in the first three scenarios in Table 1. In these scenarios, $p < x$ stems from the fact that $M1$ has the ability to run the firm herself, receiving y as a payoff. The weakly higher reservation value of manager $M1$ causes the assets to have weakly higher value when she has ownership rights. However, asset seizure by the financier is not necessarily pareto inefficient. If firm A has deep pockets *and* $\alpha \geq 1$, then $p = x$ and the assets are equally valuable to the financier and $M1$. Regardless of who wins the ownership lottery in this case, an auction would be conducted with $M2$ serving as the price-setter.

2. The Entrant Contract

2.1. Optimal Contracting

In both the baseline model and extended model (which allows for predation), the optimal entrant contract depends upon the value of ownership rights to the financier (p) and the original manager (x) evaluated at the time the two parties write the contract (t_0). The optimal contract maximizes the financier's gross return, which consists of first-stage cash flows r and the value of his ownership rights. Limited liability (LL) demands $r(\pi) \leq \pi$ at each point on the state-space $[\pi_L, \pi_H]$. From the revelation principle it follows that attention can be confined to contracts eliciting truthful reporting of first-stage profits. The global incentive compatibility (IC) condition is

$$xb(\pi) - r(\pi) \geq xb(\tilde{\pi}) - r(\tilde{\pi}) \quad \forall (\pi, \tilde{\pi}). \quad (4)$$

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

The IC condition is informative about the trade-offs facing the financier in choosing b . By increasing b marginally, the value of the financier's ownership rights falls by pb' . However, there is

an indirect gain, since $M1$ is willing to increase the reimbursement by xb' . Therefore, the net gain is $(x - p)b'$. When $x > p$ there is a net benefit to increasing b marginally. However, the LL constraint limits r' and with it b' .

The optimal contract solves

$$\max_{b,r} v \equiv \int_{\pi_L}^{\pi_H} [r(\pi) + (1 - b(\pi))p] f(\pi) d\pi \quad (5)$$

subject to

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

$$IC : r'(\pi) = xb'(\pi)$$

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

We begin by rewriting the objective function in (5) using integration by parts:⁶

$$v = r(\pi_H) + (1 - b(\pi_H))p - \int_{\pi_L}^{\pi_H} F(\pi) [r'(\pi) - pb'(\pi)] d\pi. \quad (6)$$

Then we make the following substitutions into equation (6)

$$r(\pi_H) = r(\pi_L) + \int_{\pi_L}^{\pi_H} xb'(\pi) d\pi \quad (7)$$

$$b(\pi_H) = b(\pi_L) + \int_{\pi_L}^{\pi_H} b'(\pi) d\pi.$$

It follows that any contract satisfying the IC constraint achieves a value

$$v = r(\pi_L) + p(1 - b(\pi_L)) + (x - p) \int_{\pi_L}^{\pi_H} [1 - F(\pi)] b'(\pi) d\pi. \quad (8)$$

Consider first settings where $x = p$. Inspection of (8) reveals that here any contract respecting the IC and LL constraints is optimal, provided that $r(\pi_L) = \pi_L$ and $b(\pi_L) = 0$. Such contracts yield a return to the financier of $v = \pi_L + p$. Consider next the optimal contract when $x > p$. From equation (8) it follows that it is optimal to set $r(\pi_L) = \pi_L$ and $b(\pi_L) = 0$. Starting at $b(\pi_L) = 0$, an optimal contract maximizes b' . From the IC constraint we have $b'(\pi) = r'(\pi)/x$. In order to

⁶One can also solve the program using standard optimal control. The present method is perhaps more transparent.

maximize b' while respecting both the IC and LL constraints, an optimal contract sets $r' = 1$ and $b' = 1/x$. This discussion establishes Lemma 1.

Lemma 1. *If the original manager attaches greater value to ownership rights than the financier ($x > p$), then the unique optimal entrant contract is*

$$b(\pi) = \frac{\pi - \pi_L}{x} \tag{9}$$

$$r(\pi) = \pi.$$

If the original manager and financier attach equal value to ownership rights ($x = p$), then there are many payoff-equivalent optimal contracts, including the contract (9) and a contract with $b(\pi) = 0$ and $r(\pi) = \pi_L$ for all π . In all cases, the return to the financier under the optimal contract is

$$v^* = \bar{\pi} + p \left[1 - \frac{\bar{\pi} - \pi_L}{x} \right]. \tag{10}$$

When $x > p$, the optimal entrant contract allocates all first-stage profit to the financier. In exchange for delivering the profits, the financier increases the probability that $M1$ will retain ownership. We recall that when $x > p$, asset seizure by the financier is pareto inefficient ex post, since the assets are worth more to $M1$. However, asymmetric information between $M1$ and the financier precludes pareto-improving trade ex post. Therefore, the entrant contract is renegotiation-proof. Demanding renegotiation-proofness of the entrant contract may be particularly important given that start-ups tend to have better lines of communication with their financiers than do large public firms. See Faure-Grimaud (2000) for a related discussion.

Lemma 1 also tells us that incumbent financial structure potentially influences optimal control rights for the entrant. To see this, assume $\alpha > 1$ and consider the effect of a shift in the incumbent's financial posture from shallow to deep pockets. Such a shift increases the manager's valuation of ownership rights from $x = y$ to $x = \alpha y$. Under the contract in equation (9), such an increase in x leads to decreases in b . Effectively, the increase in x allows the financier to maintain stronger

ownership rights for himself while still extracting first-stage profits. In fact, in the setting just considered, it can also be optimal to give the financier all control rights ($b = 0$). This is because the shift from shallow to deep pockets results in $p = x$. In this case, financier ownership is pareto efficient and so there is no loss in giving him full ownership rights. The more general point is that the model delivers the novel prediction that financiers retain stronger ownership rights when facing deep-pocketed incumbents.

2.2. Financier Returns: Baseline Model

Let v_s^* and v_d^* denote the financier's gross return under optimal contracts, according to whether the incumbent has shallow or deep pockets, respectively. From equation (10) it follows that

$$\begin{aligned} v_s^* &= \bar{\pi} + \ell \left[1 - \frac{\bar{\pi} - \pi_L}{y} \right] \\ v_d^* &= \bar{\pi} + \alpha y \left[1 - \frac{\bar{\pi} - \pi_L}{y} \right] \quad (\text{for } \alpha < 1) \\ v_d^* &= \pi_L + \alpha y \quad (\text{for } \alpha \geq 1). \end{aligned} \tag{11}$$

Therefore,

$$\alpha < 1 \Rightarrow v_d^* - v_s^* = (\alpha y - \ell) \left[1 - \frac{\bar{\pi} - \pi_L}{y} \right] > 0. \tag{12}$$

Condition (12) is intuitive. When $\alpha < 1$ the value obtained by the financier is higher when the incumbent has deep pockets. The value differential reflects the positive effect that the deep-pocketed incumbent has on the financier's payoff in the asset auction.

A bit of algebra reveals that

$$\alpha \geq 1 \Rightarrow v_d^* - v_s^* = (\alpha y - \ell) * \left[1 - \frac{\bar{\pi} - \pi_L}{y} \right] + (\alpha - 1)(\bar{\pi} - \pi_L) > 0. \tag{13}$$

Comparison of (13) and (12) reveals that when $M2$ has high a valuation, the gain to the financier due to the existence of a deep-pocketed incumbent is even higher. This is because stronger competition in secondary asset markets leads to higher auction prices *and* enables the financier to offer less generous ownership rights to $M1$.

Conditions (12) and (13) illustrate clearly the strategic cost of deep pockets for the incumbent, since the increase in the financier's payoff increases the likelihood of entry. However, these costs must be weighed against the strategic benefit arising from deep pockets, namely the ex ante value of precommitting to make an acquisition if entry occurs.

3. Optimal Financial Posture for Incumbent: Baseline Model

Having determined the optimal entrant contract, and the effect of the incumbent's financial condition on that contract, we can now turn to the optimal financial posture of the incumbent. This section focuses on the baseline model, which rules out predation. In this setting, the incumbent has two lines of defense. The first line of defense is entry-deterrence. The second line of defense is acquisition of a successful entrant at time t_2^- , prior to second-stage product market competition.

Let (V_d, V_s) denote the value at time t_{-1} of the claim held by the incumbent according to whether he adopts deep or shallow pockets. The appendix shows that in the baseline model one may confine attention to these two financial postures without loss of generality. The intuition is as follows. Intermediate financial postures are dominated since they either raise asset prices and/or prevent the incumbent from making an acquisition. In other words, the incumbent only wants to participate in asset auctions if he will acquire the entrant's assets. Unsuccessful participation in the asset auction only serves to drive up asset prices and encourage entry. We summarize this conclusion in the following lemma.

Lemma 2. *In the baseline model, the optimal incumbent financial structure will induce a willingness-to-pay for entrant assets that is either weakly less than ℓ or strictly greater than $\max\{\alpha y, y\}$.*

Proof. See Appendix.

If the incumbent adopts shallow pockets, entry occurs with probability $Z(v_s^*)$. In the event of entry, the incumbent does not acquire the competitor and he earns the duopoly profit in both periods. If $i > v_s^*$, entry is deterred and the incumbent earns the monopoly profit in both periods.

It follows that the value of the equity held by the incumbent under the shallow pockets strategy at time t_{-1} is⁷

$$V_s = [1 - Z(v_s^*)][\bar{\Pi}_1^m + \bar{\Pi}_2^m] + Z(v_s^*)[\bar{\Pi}_1^d + \bar{\Pi}_2^d]. \quad (14)$$

Suppose next that the incumbent has deep pockets. In this case, the probability of entry is $Z(v_d^*)$. If no entry occurs, the incumbent earns the monopoly profit in both periods. If entry occurs, the incumbent earns the duopoly profit at t_1 . The deep-pocketed incumbent then eliminates competition in the second period through an acquisition. Therefore, expected profits at t_2 are $\bar{\Pi}_2^m$. The cost of the acquisition depends on whether the financier or $M1$ has ownership rights.

Let $\xi(\alpha)$ denote the expected acquisition cost for the deep-pocketed incumbent. As shown in Table 1, when $\alpha \geq 1$ the acquisition cost is αy regardless of how ownership is allocated between the financier and $M1$. If $\alpha < 1$, the incumbent must pay αy if he acquires the assets from the financier and he must pay a higher price y if he acquires the assets from $M1$. A bit of algebra reveals the expected cost of the acquisition to be:

$$\begin{aligned} \alpha < 1 &\Rightarrow \xi(\alpha) = y - (1 - \alpha)[y - (\bar{\pi} - \pi_L)] < y \\ \alpha \geq 1 &\Rightarrow \xi(\alpha) = \alpha y. \end{aligned} \quad (15)$$

It is worth noting that $\xi(\alpha)$ is increasing in α . Intuitively, the incumbent must pay a higher acquisition premium the higher the valuation of the rival bidder ($M2$).

From this analysis it follows that the value of the equity held by the incumbent under the deep pockets strategy at time t_{-1} is

$$V_d = [1 - Z(v_d^*)][\bar{\Pi}_1^m + \bar{\Pi}_2^m] + Z(v_d^*)[\bar{\Pi}_1^d + \bar{\Pi}_2^m - \xi]. \quad (16)$$

Let $\gamma \equiv V_s - V_d$ denote the gain to adopting shallow pockets rather than deep pockets. Shallow pockets is chosen only if $\gamma \geq 0$. We have

$$\gamma = [Z(v_d^*) - Z(v_s^*)][\Delta\bar{\Pi}_1 + \Delta\bar{\Pi}_2] - Z(v_d^*)[\Delta\bar{\Pi}_2 - \xi]. \quad (17)$$

⁷In fact, the same valuation is achieved for all debt commitments with $WTP \in [0, \ell]$.

Equation (17) illustrates clearly the fundamental trade-off associated with choosing between deep and shallow pockets. The first term represents the value gained from the entry-deterrence provided by shallow pockets, recalling $v_d^* > v_s^*$. The second term represents the expected NPV from making an acquisition in the event that entry occurs.

Differentiating γ allows us to determine factors that increase or decrease the attractiveness of shallow pockets. Factors that increase γ serve to increase the attractiveness of shallow pockets. First note that

$$\frac{\partial \gamma}{\partial \alpha} = Z(v_d^*)\xi'(\alpha) + z(v_d^*)\frac{\partial v_d^*}{\partial \alpha}[\Delta\bar{\Pi}_1 + \xi] > 0. \quad (18)$$

Thus, increases in α make shallow pockets more attractive. Recall that the advantage of deep pockets is that the incumbent maintains his willingness to make the positive NPV acquisition, should entry occur. When α is high, the incumbent must pay a high acquisition cost, reducing the NPV of an acquisition. This effect is captured by the first term in equation (18). Since higher values of α result in higher acquisition premia, they also raise financier returns. This increases the likelihood of entry and further reduces the attractiveness of deep pockets. This effect is captured by the second term in equation (18).

The shallow pockets strategy becomes less attractive as the liquidation value of assets increase, since increases in liquidation values increase v_s^* and the likelihood of entry despite the adoption of shallow pockets. More formally, we have

$$\frac{\partial \gamma}{\partial \ell} = -z(v_s^*)\frac{\partial v_s^*}{\partial \ell}[\Delta\bar{\Pi}_1 + \Delta\bar{\Pi}_2] < 0. \quad (19)$$

It is easily verified that the shallow pockets strategy becomes more attractive when the first-stage monopoly rent is high, since

$$\frac{\partial \gamma}{\partial \Delta\bar{\Pi}_1} = Z(v_d^*) - Z(v_s^*) > 0. \quad (20)$$

Intuitively, the shallow pockets strategy increases the probability of entry-deterrence and monopoly power in period t_1 . The larger the gain from the t_1 monopoly, the more attractive is the shallow pockets strategy.

The shallow pockets strategy becomes less attractive when the second-stage monopoly rent is high, since

$$\frac{\partial \gamma}{\partial \Delta \bar{\Pi}_2} = -Z(v_s^*) < 0.$$

The intuition is as follows. The shallow-pocketed firm only captures the monopoly rent in the second period if entry does not take place. In contrast, the deep-pocketed incumbent always has monopoly power in the second period. Thus, second period monopoly rents have a larger effect on incumbent firm value under deep pockets. Taken together, these results tell us that the shallow pockets strategy is more attractive for value firms than for growth firms, since the former derive a greater portion of their value from near-term profits.

We summarize the results of the section in the following proposition.

Proposition 1. *Shallow pockets is optimal if*

$$\frac{Z(v_s^*)}{Z(v_d^*)} \leq \frac{\Delta \bar{\Pi}_1 + \xi}{\Delta \bar{\Pi}_1 + \Delta \bar{\Pi}_2}. \quad (21)$$

The attractiveness of shallow pockets increases in short-term monopoly rents; increases in the asset valuation of the rival bidder; decreases in long-term monopoly rents; and decreases in asset liquidation values.

4. Predation versus Acquisition

Bolton and Scharfstein (1990) (BS below) show financial slack can potentially be rationalized by the motive to maintain predation capability. This section explores this line of reasoning in greater detail. In order to do so within our model we cannot use the predation technology featured in the BS model, however. In the BS model, the predation technology consists of the incumbent paying a cost in order to increase the probability of low first-stage profits for the entrant. Their model assumes the only punishment available to the financier is a “liquidation” which removes the upstart from the product market in the second period. However, we have argued that a financier need not remove assets from their highest value use in order to punish low profit reports, and in fact cannot credibly

commit to do so. Realistically, a financier can and will simply seize assets and sell them at the highest possible price. As argued by Shleifer and Vishny (1992), assets are typically redeployed in the same industry because of their industry specificity. In addition, from the perspective of optimal contracting, the higher sales price when assets are sold for maximum value, rather than liquidated, improves the credibility of contract enforcement. Therefore, entrant assets are unlikely to migrate outside the incumbent's market in equilibrium. Our model of predation is designed to capture this economic reality.

A second critical difference between the two models is in the set of strategic options that are assumed to be available to the incumbent. In the BS model, the incumbent chooses between predation and accommodation. In our model, the incumbent also has the option to acquire the upstart. This added option to acquire leads to radically different conclusions about the relationship between leverage and credible predation. In particular, we show that while an unlevered incumbent certainly has the means to engage in predation, he will generally prefer to acquire competitors. However, by taking on a sufficient amount of debt, the threat of predation can be made credible.

4.1. *The Choice between Predation, Acquisition, and Do-Nothing*

A time-line of events for the extended model with predation is provided in Figure 2. At time t_2^- the incumbent has three *mutually exclusive* options: acquisition; predation; or do-nothing. The cost of predation is $\phi \geq 0$. If successful, predation renders the assets of the entrant useless within the industry during period t_2 . Successful predation gives the incumbent a monopoly in period t_2 and reduces the market value of the entrant's assets to their value out-of-industry, which is ℓ .⁸ The probability of successful predation is $\theta \in (0, 1)$. For example, if the entrant's critical asset is its brand name, the predation technology can be viewed as approximating negative advertising directed against an upstart. If the entrant or incumbent holds a patent, then the predation technology can be viewed as approximating lawsuits challenging the entrant for patent infringement. The assumption that predation has an uncertain outcome follows the argument put forth by Telser (1966) and

⁸At this point, we assume that the market amongst asset liquidators is competitive and all value the assets at ℓ .

continued by Bolton and Scharfstein (1990) that this is a necessary condition for predation to be observed in equilibrium; otherwise the entrant would exit immediately when exposed to a credible threat of predatory activities.

“Do-nothing” means that the incumbent will neither acquire the upstart nor engage in predation. If the incumbent opts for do-nothing, or if predation fails, then the assets will be operated independently by either the current manager $M1$ or the rival $M2$, depending on the outcome of the ownership lottery in t_1 . Within the set of financial postures that induce do-nothing, it is clearly ex ante optimal for the incumbent to choose a debt level sufficiently high such that it does not push up asset prices in secondary asset markets by making unsuccessful bids for entrant assets. Thus, any ex ante optimal posture inducing do-nothing must entail $D \geq D(\ell)$, since this lowers willingness-to-pay below ℓ .

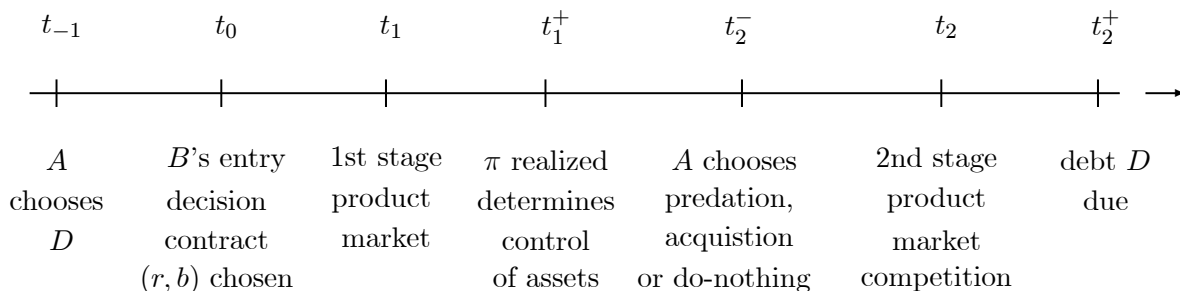


Figure 2: Time Line in Extended Model

For simplicity, the remainder of the paper assumes managers $M1$ and $M2$ are equally productive. Specifically, we assume

$$A4 : \alpha = 1.$$

Assumption A4 is not essential for our conclusions, but serves to simplify the analysis. In particular, A4 ensures that the price of acquiring the entrant is equal to y regardless of whether ownership rights at time t_1^+ are held by $M1$ or the financier.

Consider now the *ex post* (t_2^-) continuation payoff to the incumbent under his three available responses to entry: predation (P), acquisition (A) or do-nothing (N). These payoffs are denoted by

Ω_P , Ω_A and Ω_N , respectively. We have

$$\Omega_P(D) \equiv \theta \int_D^{\Pi_H} (\Pi - D)g(\Pi)d\Pi + (1 - \theta) \int_D^{\Pi_H} (\Pi - D)h(\Pi)d\Pi - \phi. \quad (22)$$

$$\Omega_A(D) \equiv \int_D^{\Pi_H} (\Pi - D)g(\Pi)d\Pi - y. \quad (23)$$

$$\Omega_N(D) \equiv \int_D^{\Pi_H} (\Pi - D)h(\Pi)d\Pi. \quad (24)$$

Rearranging terms, one can rewrite the continuation payoff to predation as

$$\Omega_P(D) = \theta\Omega_A(D) + (1 - \theta)\Omega_N(D) + \theta y - \phi. \quad (25)$$

We now turn to the question how the incumbent's financial structure influences his response to entry. Figure 3 compactly summarizes the analysis. Formal proofs are presented in the appendix.

Consider first the choice between acquisition and do-nothing. Rearranging terms, we see that

$$\Omega_A(D) - \Omega_N(D) = \beta(D) - y, \quad (26)$$

where β is the willingness-to-pay function from Section 1. From the properties of the function β , it is readily verified that there exists a unique debt level $D_1 \in (\Pi_L, D(\ell))$ such that the incumbent will be just indifferent between acquisition and do-nothing.

Consider adding predation to the picture. If the incumbent has debt D_1 , then $\Omega_A(D_1) = \Omega_N(D_1)$. If $D = D_1$ and $\phi = \theta y$, it follows from equation (25) that the incumbent is indifferent between the three responses to entry. This indifference point is labeled X in Figure 3. Equation (25) also shows that predation is dominated by either acquisition or do-nothing for higher predation costs, $\phi > \theta y$. Therefore, if $\phi > \theta y$, the only credible responses to entry are acquisition and do-nothing, with the latter being chosen for all $D > D_1$.

Consider now the choice between predation and acquisition, assuming $\phi \leq \theta y$. It is readily verified that the relative attractiveness of predation increases with debt. To see this note that

$$D \in (\Pi_L, \Pi_H) \Rightarrow \Omega'_P(D) - \Omega'_A(D) = (1 - \theta)[H(D) - G(D)] > 0. \quad (27)$$

The reason is that the distribution of profits under acquisition is first-order stochastic dominant relative to those under predation. Thus, the value of levered equity under the acquisition strategy is more sensitive to marginal increases in debt.

Not surprisingly, if ϕ is sufficiently small, the incumbent prefers predation to acquisition regardless of his debt level. To see this note that,

$$D \leq \Pi_L \Rightarrow \Omega_P(D) - \Omega_A(D) = y - (1 - \theta) \Delta \bar{\Pi}_2 - \phi. \quad (28)$$

From (27) and (28) it follows that if $\phi < y - (1 - \theta) \Delta \bar{\Pi}_2$, predation is strictly preferred to acquisition ex post for all D . For higher levels of predation costs, one can determine a debt level such that the incumbent is just indifferent between predation and acquisition. This is the increasing schedule D_2 in Figure 3. The positive slope of D_2 is explained by the fact that, if ϕ is increased, indifference between predation and acquisition can only be maintained if there is a compensating increase in D .

Finally, consider the choice between predation and do-nothing. There is a debt schedule such that the incumbent is just indifferent between the two. This function is labeled D_3 . One point on the schedule is the pair $(\phi, D) = (0, \Pi_H)$. To determine the slope, note that marginal increases in debt increase the relative attractiveness of do-nothing. Intuitively, predation offers first-order stochastic dominant profits relative to do-nothing, so levered equity value under predation is more sensitive to marginal increases in debt. Therefore, as ϕ is increased, indifference between predation and do-nothing is maintained only if there is a compensating decrease in D .

We summarize the formal results (illustrated in Figure 3) as follows.

Proposition 2. *The incumbent response to entry depends on D and ϕ . (i) If $\phi > \theta y$, then $D \leq D_1$ induces acquisition and $D > D_1$ induces do-nothing. (ii) If $\phi < y - (1 - \theta) \Delta \bar{\Pi}_2$ then for all $D \leq D_3(\phi)$ the incumbent chooses predation and for all $D > D_3(\phi)$ the incumbent chooses do-nothing. (iii) If $\phi \in [y - (1 - \theta) \Delta \bar{\Pi}_2, \theta y]$, then $D < D_2(\phi)$ induces acquisition; $D \in [D_2(\phi), D_3(\phi)]$ induces predation; and $D > D_3(\phi)$ induces do-nothing.*

Proof: See Appendix.

4.2. Predation and Financier Returns

To facilitate comparison with the baseline model, financier returns are denoted v^{**} in the extended model that allows for predation. It was shown in Proposition 2 that the incumbent's reaction to entry is determined by the debt D it chooses at date t_{-1} and the cost of predation ϕ . We now analyze the impact of the incumbent's choice between acquisition, predation and do-nothing on the financier return.

Consider first the case in which (ϕ, D) are such that the incumbent will choose do-nothing in response to entry, recalling that, within this set, it will always be optimal to choose $D \geq D(\ell)$ in order to prevent a positive feedback effect on equilibrium asset prices. In this case, if the financier seizes the assets, his only option is to sell to $M2$ for a price of $p = \ell$. If $M1$ retains ownership then she obtains a benefit $x = y$ by continuing to run the firm herself in t_2 . From Lemma 1, the financier obtains

$$v_N^{**} = \bar{\pi} + \ell \left[1 - \frac{\bar{\pi} - \pi_L}{y} \right]. \quad (29)$$

Next, suppose (ϕ, D) are such that the incumbent chooses predation in response to entry. Anticipating predation, $M1$ lowers her ex ante valuation of ownership rights to $x = \theta\ell + (1 - \theta)y$. The financier values ownership rights at $p = \ell$. Applying Lemma 1, we find

$$v_P^{**} = \bar{\pi} + \ell \left[1 - \frac{\bar{\pi} - \pi_L}{\theta\ell + (1 - \theta)y} \right]. \quad (30)$$

Clearly, $v_P^{**} < v_N^{**}$. This is quite intuitive. Under the optimal contract, $M1$ delivers all first-stage profits to the financier in exchange for control rights. However, anticipated predation causes $M1$ to place a lower value on control rights. This reduces her incentive to deliver first-stage profits to the financier, ceteris paribus. In order for the financier to compel delivery of first-stage profits, he must cede greater control rights to $M1$. Thus, the wedge between v_N^{**} and v_P^{**} is explained entirely by the weaker control rights retained by the financier.

Finally, consider the case in which (ϕ, D) are such that the incumbent responds to entry by making an acquisition. The equilibrium auction price is y since the incumbent participates in the

auction. Manager $M1$ also attaches value y to ownership rights. Thus, we have $p = x = y$. The financier return is

$$v_A^{**} = \pi_L + y. \quad (31)$$

We note that v_N^{**} in expression (29) is strictly less than v_A^{**} in expression (31) since $\ell < y$. Thus, we find that

$$v_A^{**} > v_N^{**} > v_P^{**}. \quad (32)$$

Entry is most likely if the incumbent will respond to entry with an acquisition and least attractive if the incumbent will respond to entry with predation.

4.3 Predation and Optimal Incumbent Financial Posture

We now move back in time to the incumbent's choice of financial structure at time t_{-1} . The value of the claim held by the incumbent *ex ante* (at time t_{-1}) hinges upon his equilibrium response to entry. Incumbent firm value in the three regions in which predation (P), acquisition (A) or do-nothing (N) are the optimal reactions to entry, are respectively:

$$\tilde{V}_P = [1 - Z(v_P^{**})][\bar{\Pi}_1^m + \bar{\Pi}_2^m] + Z(v_P^{**})[\bar{\Pi}_1^d + \theta\bar{\Pi}_2^m + (1 - \theta)\bar{\Pi}_2^d - \phi] \quad (33)$$

$$\tilde{V}_A = [1 - Z(v_A^{**})][\bar{\Pi}_1^m + \bar{\Pi}_2^m] + Z(v_A^{**})[\bar{\Pi}_1^d + \bar{\Pi}_2^m - y] \quad (34)$$

$$\tilde{V}_N = [1 - Z(v_N^{**})][\bar{\Pi}_1^m + \bar{\Pi}_2^m] + Z(v_N^{**})[\bar{\Pi}_1^d + \bar{\Pi}_2^d]. \quad (35)$$

We begin by making bilateral comparisons between the three incumbent reactions that are induced by his initial leverage choice. The optimal long-term debt commitment is denoted D^* . If $\phi > \theta y$, the choice is between acquisition and do-nothing since predation is herein dominated *ex post*. Comparing the incumbent's *ex ante* payoff under the two relevant scenarios, we find

$$\frac{Z(v_N^{**})}{Z(v_A^{**})} \leq \frac{\Delta\bar{\Pi}_1 + y}{\Delta\bar{\Pi}_1 + \Delta\bar{\Pi}_2} \Leftrightarrow \tilde{V}_N \geq \tilde{V}_A. \quad (36)$$

If this condition holds and do-nothing is preferred, then $D^* \geq D(\ell) > D_1$ in order to maximize the entry-deterrence effect. Condition (36) is identical to the ratio test (21) in the baseline model, stated in Proposition 1. This is intuitive. When ϕ is sufficiently high, predation becomes irrelevant

and we return to the choice between financial structures inducing either acquisition or do-nothing. Alternatively, we can write the condition under which the commitment to do-nothing is optimal as:

$$\tilde{V}_N \geq \tilde{V}_A \Leftrightarrow Z(v_A^{**}) [\Delta\bar{\Pi}_2 - y] \leq [Z(v_A^{**}) - Z(v_N^{**})] [\Delta\bar{\Pi}_1 + \Delta\bar{\Pi}_2]. \quad (37)$$

Intuitively, the condition above states that the commitment to do-nothing will be optimal when the value of entry deterrence exceeds the loss in NPV from the acquisition.

Consider next the opposite extreme, where predation costs are extremely small in the sense that $\phi < y - (1 - \theta) \Delta\bar{\Pi}_2$. From Proposition 2 we know the incumbent must choose (ex ante) between financial structures inducing either predation or do-nothing, since acquisition is dominated by predation ex post. It is readily verified that ex ante the commitment to predation dominates the commitment to do-nothing since

$$\tilde{V}_P - \tilde{V}_N = [Z(v_N^{**}) - Z(v_P^{**})] [\Delta\bar{\Pi}_1 + \Delta\bar{\Pi}_2] + Z(v_P^{**}) [\theta\Delta\bar{\Pi}_2 - \phi] > 0. \quad (38)$$

Intuitively, do-nothing is dominated by predation from an ex ante perspective since the commitment to predate reduces the probability of entry and also gives the incumbent a positive-NPV investment in predation ex post. Both effects are clearly illustrated in equation (38).

We are left with the intermediate region $\phi \in [y - (1 - \theta) \Delta\bar{\Pi}_2, \theta y]$. For this range of ϕ values, equation (38) once again establishes that predation dominates do-nothing from an ex ante perspective. Thus, we need only compare the ex ante payoff induced by precommitment to predation versus acquisition. A bit of algebra reveals

$$\frac{Z(v_P^{**})}{Z(v_A^{**})} \leq \frac{\Delta\bar{\Pi}_1 + y}{\Delta\bar{\Pi}_1 + \Delta\bar{\Pi}_2 - (\theta\Delta\bar{\Pi}_2 - \phi)} \Leftrightarrow \tilde{V}_P \geq \tilde{V}_A. \quad (39)$$

We may rewrite this condition in an intuitive form as:

$$\tilde{V}_P \geq \tilde{V}_A \Leftrightarrow Z(v_A^{**}) [\Delta\bar{\Pi}_2 - y] - Z(v_P^{**}) (\theta\Delta\bar{\Pi}_2 - \phi) \leq [Z(v_A^{**}) - Z(v_P^{**})] [\Delta\bar{\Pi}_1 + \Delta\bar{\Pi}_2]. \quad (40)$$

The left side of the inequality stated in equation (40) measures the difference in the NPV coming from acquisition and that from predation. The right side of the inequality measures the entry deterrence

benefit coming from the commitment to predate. In particular, the commitment to predate has a pushing effect while the commitment to acquire has a pulling effect. If this entry-deterrence effect is sufficiently large, financial structures inducing predation ex post are dominant from an ex ante perspective.

We summarize the analysis of the incumbent's optimal debt level with the following proposition.

Proposition 3. *(i) For large predation costs $\phi > \theta y$, if condition (36) is satisfied then $D^* \in [D(\ell), \Pi_H]$ and $D^* \leq D_1$ if not. (ii) For intermediate predation costs $\phi \in [y - (1 - \theta) \Delta \bar{\Pi}_2, \theta y]$, if condition (39) is satisfied then $D^* \in [D_2(\phi), D_3(\phi)]$ and $D^* < D_2(\phi)$ if not. (iii) For low predation costs $\phi < y - (1 - \theta) \Delta \bar{\Pi}_2$, $D^* \leq D_3(\phi)$.*

Perhaps the scenario of intermediate predation costs described in part (ii) of Proposition 3 most clearly illustrates the trade-offs in the incumbent's capital structure choice. As shown in Figure 3, the incumbent can precommit to acquisition, predation, or do-nothing by choosing an appropriate level of debt. When condition (39) is satisfied, the incumbent would like to precommit to predation. This entails a balancing act. By issuing a sufficient amount of debt, the incumbent can credibly convey a preference for predation over the safety of an acquisition. However, if the debt level is too large, the debt overhang effect causes the incumbent to forego all investments ex post. Thus, the pledge to engage in predation is only credible when the firm chooses intermediate debt levels.

Proposition 3 shows that adding the predation option to the baseline model actually increases the attractiveness of shallow pockets, contrary to the traditional "long purse" argument. Formally, by comparing the ratio test in equation (21) of the baseline model with the corresponding ratio test (39) in the extended model with predation, it is readily verified that the latter is weaker. Thus, the availability of predation makes it more likely that shallow pockets are adopted in all cases except if predation costs are very high and have no impact ($\phi > \theta y$). Two factors explain this potentially surprising result. First, since predation lowers expected asset values, the entry-deterrence benefit from shallow pockets is magnified. Second, the ability to engage in predation lowers the downside risk associated with a leveraged financial structure, since predation represents a second line of defense

should the attempt at entry deterrence fail.

5. Predation Preceding Acquisition

Section 4 considered a setting where the incumbent faced a mutually exclusive choice between predation and acquisition in response to entry. In reality, the sequencing of various decisions varies across sectors. This section considers how results change with timing assumptions. We show that the main causal mechanism in our paper is robust. In particular, it is shown that the entry-deterrence benefit of shallow pockets remains valid even if we include an additional option value of deep pockets, by allowing the incumbent to absorb the entrant in an acquisition if predation fails.

We return to the setup of Section 4, but now assume that at time t_2^- the incumbent makes two *sequential* decisions. The incumbent first has the ability to engage in predation and observe whether it is successful. If the incumbent fails to predate or engaged in failed predation, he is then free to make an acquisition. That is, the incumbent can first engage in predation, and still participate in the acquisition market for the assets.

5.1. Analysis of Sequential Decisions

In order to assess optimal incumbent financial posture at t_{-1} , we must determine how leverage affects his response to entry. Figure 4 provides a compact summary. Working back in time, we begin at the acquisition decision node. At this node, the incumbent's continuation value is Ω_A if he acquires and Ω_N if not. The analysis in Section 4 shows that the incumbent will acquire if and only if $D \leq D_1$.

We consider first the predation decision and ex ante payoffs for incumbents with $D \leq D_1$. At the predation decision node, anticipating that the following decision will be an acquisition, the incumbent achieves a continuation value of $\Omega_{PA} = \Omega_A + \theta y - \phi$ if he engages in predation and Ω_A if not. The subscript PA denotes the scenario of predation followed by acquisition that is now a fourth possible outcome besides acquisition (A), predation (P) and do-nothing (N). It follows that if $D \leq D_1$ and $\phi > \theta y$, the incumbent responds to entry by making an acquisition. If $D \leq D_1$

and $\phi \leq \theta y$, the incumbent initially responds to entry with predation and makes an acquisition if predation fails.

If the incumbent responds to entry by making an acquisition, his ex ante payoff remains equal to \tilde{V}_A as computed in Section 4. We shall use \tilde{V}_{PA} and v_{PA}^{**} to denote incumbent and financier payoffs, respectively, in the new scenario in which the incumbent responds to entry with predation-acquisition sequentially. In this case, $M1$ and the financier both value ownership rights (ex ante) at $x = p = \theta\ell + (1 - \theta)y$. It follows from Lemma 1 that

$$v_{PA}^{**} = \pi_L + \theta\ell + (1 - \theta)y. \quad (41)$$

The incumbent's ex ante payoff can here be computed as

$$\tilde{V}_{PA} = [1 - Z(v_{PA}^{**})][\bar{\Pi}_1^m + \bar{\Pi}_2^m] + Z(v_{PA}^{**})[\bar{\Pi}_1^d + \theta\bar{\Pi}_2^m + (1 - \theta)(\bar{\Pi}_2^m - y) - \phi]. \quad (42)$$

Consider next the predation decision and ex ante payoffs for firms with $D > D_1$. At the predation decision node, the incumbent attains a continuation value of Ω_P if he engages in predation and Ω_N if not. For $\phi \in [0, \theta y]$ we again define a schedule $D_3(\phi)$ such that $\Omega_P[D_3(\phi)] = \Omega_N[D_3(\phi)]$. For $D > \max(D_1, D_3)$, the incumbent neither engages in predation nor makes acquisitions. Within the set of debt levels inducing do-nothing, it is clearly ex ante optimal to choose $D \geq D(\ell)$, in order to avoid exerting upward pressure on auction values. For $D \geq D(\ell)$, the incumbent receives an ex ante payoff equal to \tilde{V}_N as computed in Section 4.

This leaves us with one case to consider. If $\phi \in [0, \theta y]$, all $D \in (D_1, D_3(\phi))$ induce predation followed by no-acquisition should the predation fail. Before proceeding with a comparison of debt levels in this set, it is useful to identify the critical value of the predation costs, call it $\hat{\phi}$, such that $D_3(\hat{\phi}) = D(\ell)$. This is readily computed using

$$\begin{aligned} \Omega_P[D_3(\phi)] &\equiv \Omega_N[D_3(\phi)] \quad \forall \phi \in [0, \theta y] \\ &\Rightarrow \phi = \theta\beta[D_3(\phi)] \quad \forall \phi \in [0, \theta y] \\ &\Rightarrow \hat{\phi} = \theta\beta[D_3(\hat{\phi})] = \theta\beta[D(\ell)] = \theta\ell. \end{aligned} \quad (43)$$

Within the set of debt levels inducing predation, it is ex ante optimal to minimize upward pressure on asset auction values, since this minimizes entry probability. If $\phi \leq \theta\ell$, the incumbent can implement predation and avoid putting any upward pressure on auction prices by choosing $D \in [D(\ell), D_3(\phi)]$. In such cases, $x = \theta\ell + (1 - \theta)y$, $p = \ell$, and the incumbent's ex ante payoff remains equal to \tilde{V}_P as computed in Section 4.

If $\phi \in (\theta\ell, \theta y]$, all debt levels inducing predation necessarily induce upward pressure on auction prices. Within this set, it is optimal ex ante to choose the highest debt level $D = D_3(\phi)$, since this minimizes feedback effects on auction prices. Under this policy we have $x = \theta\ell + (1 - \theta)y$ and $p = \theta\ell + (1 - \theta)\beta[D_3(\phi)] > \ell$. For this case, we denote the resulting ex ante payoff for the incumbent and financier by \hat{V}_P and \hat{v}_P , respectively. Applying Lemma 1, we find

$$\hat{v}_P = \bar{\pi} + [\theta\ell + (1 - \theta)\beta(D_3(\phi))] \left[1 - \frac{\bar{\pi} - \pi_L}{\theta\ell + (1 - \theta)y} \right]. \quad (44)$$

The incumbent's return is:

$$\hat{V}_P = [1 - Z(\hat{v}_P)][\bar{\Pi}_1^m + \bar{\Pi}_2^m] + Z(\hat{v}_P)[\bar{\Pi}_1^d + \theta\bar{\Pi}_2^m + (1 - \theta)\bar{\Pi}_2^d - \phi]. \quad (45)$$

It is readily verified that

$$v_{PA}^{**} > \hat{v}_P > v_P^{**}. \quad (46)$$

Intuitively, the incumbent will trigger a run-up in auction prices to y if he makes acquisitions, and to $\beta(D_3(\phi)) \in (\ell, y)$ if he commits to predation facing $\phi \in (\theta\ell, \theta y]$. Finally, auction prices remain equal to ℓ when the incumbent commits to predation facing $\phi \leq \theta\ell$.

5.2 Optimal Incumbent Financial Posture When Predation Precedes Acquisition

Having computed all feasible ex ante payoffs, we can now determine the incumbent's optimal financial structure at t_{-1} . If predation costs are high, with $\phi > \theta y$, the only credible policies ex post are do-nothing and acquisition. The optimal decision is then determined by criterion (37). Once again, the optimal financial posture depends upon the relative magnitude of the entry deterrence benefit from shallow pockets relative to the NPV from acquisition investments. When the former is larger, the optimal debt is $D \in (D(\ell), \Pi_H]$. When the latter is larger, the optimal debt is $D \leq D_1$.

If predation costs are low ($\phi \leq \theta\ell$) the firm can implement three policies ex post, with maximal ex ante payoffs in parentheses: predation followed by acquisition (\tilde{V}_{PA}); predation with no auction price pressure (\tilde{V}_P); and do-nothing (\tilde{V}_N). From equation (38) it follows that debt levels inducing do-nothing are dominated ex ante by those inducing predation. Thus, we need only compare the ex ante payoffs induced by predation and predation-acquisition. Rearranging terms, one obtains an intuitive condition for the dominance of the shallow-pocketed strategy:

$$\begin{aligned} \tilde{V}_P \geq \tilde{V}_{PA} &\Leftrightarrow \\ Z(v_{PA}^{**}) [\theta\Delta\bar{\Pi}_2 + (1-\theta)(\Delta\bar{\Pi}_2 - y) - \phi] - Z(v_P^{**}) (\theta\Delta\bar{\Pi}_2 - \phi) & \quad (47) \\ \leq [Z(v_{PA}^{**}) - Z(v_P^{**})] [\Delta\bar{\Pi}_1 + \Delta\bar{\Pi}_2] . & \end{aligned}$$

The left side of inequality (47) measures the difference in NPVs coming from investments in response to entry. The deep-pocketed firm undertakes two positive NPV investments in response to entry: predation and acquisition. The shallow-pocketed firm passes up the positive NPV acquisition investment. The right side captures the corresponding entry deterrence benefit arising from the precommitment to forego acquisition.

For intermediate values of predation costs, $\phi \in (\theta\ell, \theta y]$, the firm can again implement three policies ex post, with maximal ex ante payoffs in parentheses: predation followed by acquisition (\tilde{V}_{PA}); predation with auction price pressure (\hat{V}_P); and do-nothing (\tilde{V}_N). The comparison between strategies inducing do-nothing and those inducing predation is now more involved since the dominance relation of (38) is no longer necessarily true. A sufficient condition for satisfaction of condition (38) is that $\hat{v}_P \leq v_N^{**}$. However, the relationship between \hat{v}_P and v_N^{**} is ambiguous. That is, in the present case it is unclear whether the predation stance is superior to do-nothing in terms of entry deterrence. On one hand, credible predation reduces financier returns. However, stances inducing credible predation are here associated with upward pressure on auction prices and financier returns. On a right-neighborhood for ϕ about $\theta\ell$, $\hat{v}_P \leq v_N^{**}$ necessarily holds and $\hat{V}_P > \tilde{V}_N$. We next observe that $\hat{V}_P - \tilde{V}_N$ declines monotonically in ϕ on the interval $\phi \in (\theta\ell, \theta y]$. In this interval, $\hat{V}_P > \tilde{V}_N$ if

$$\hat{V}_P - \tilde{V}_N = [Z(v_N^{**}) - Z(\hat{v}_P)] [\Delta\bar{\Pi}_1 + \Delta\bar{\Pi}_2] + Z(\hat{v}_P) [\theta\Delta\bar{\Pi}_2 - \phi] > 0 . \quad (48)$$

If condition (48) holds, we need only compare the ex ante payoffs induced by predation and predation-acquisition. Rearranging terms, one obtains a condition analogous to (47) for the dominance of the shallow-pocketed strategy:

$$\begin{aligned} \widehat{V}_P \geq \widetilde{V}_{PA} &\Leftrightarrow \\ Z(v_{PA}^{**}) [\theta \Delta \bar{\Pi}_2 + (1 - \theta) (\Delta \bar{\Pi}_2 - y) - \phi] - Z(\widehat{v}_P) (\theta \Delta \bar{\Pi}_2 - \phi) \\ &\leq [Z(v_{PA}^{**}) - Z(\widehat{v}_P)] [\Delta \bar{\Pi}_1 + \Delta \bar{\Pi}_2] . \end{aligned} \quad (49)$$

We mention that a sufficient condition for $\widehat{V}_P > \widetilde{V}_N$ on the entire interval is that $v_N^{**} \geq \widehat{v}_P$ even when the latter is evaluated at $\phi = \theta y$. Comparing condition (29) to (44) this sufficient condition can be stated as:

$$\theta \geq 1 - \frac{\bar{\pi} - \pi_L}{y} . \quad (50)$$

If condition (48) does not hold for some $\phi \in (\theta \ell, \theta y]$, then the choice is only between do-nothing and predation-acquisition over this range, and the latter is preferred if:

$$\widetilde{V}_{PA} \geq \widetilde{V}_N \Leftrightarrow Z(v_{PA}^{**}) [\Delta \bar{\Pi}_1 + (1 - \theta) y + \phi] \geq Z(v_N^{**}) [\Delta \bar{\Pi}_1 + \Delta \bar{\Pi}_2] . \quad (51)$$

We summarize these results in the following Proposition.

Proposition 4. (i) For high predation costs ($\phi > \theta y$) if condition (36) is satisfied then $D^* \in [D(\ell), \Pi_H]$ and $D^* \leq D_1$ if not. (ii) For intermediate predation costs ($\phi \in (\theta \ell, \theta y]$), if conditions (48) and (49) are satisfied then $D^* = D_3(\phi)$; if neither condition (48) nor (51) is satisfied then $D^* > D_3(\phi)$; and $D^* \leq D_1$ in all other cases. (iii) If predation costs are low, with $\phi \leq \theta \ell$, then $D^* \in [D(\ell), D_3(\phi)]$ if condition (47) is satisfied and $D^* \leq D_1$ if not.

The analysis of this section shows that, even with sequential decisions, the incumbent still faces a fundamental trade-off between entry deterrence and ex post flexibility. In particular, higher debt levels serve to reduce asset prices, but also limit the incumbent's incentive to make positive NPV investments in response to entry. A comparison of Proposition 4 and Proposition 3 reveals ambiguous effects arising from the possibility of engaging in predation and acquisition sequentially.

On one hand, comparing (47) and (49) to (40) shows that the parameter region over which the incumbent opts for deep pockets increases when predation attempts precede acquisition. Intuitively, the possibility of attempting predation prior to acquisition weakens the pulling effect associated with deep pockets. On the other hand, the incumbent will more frequently prefer stances inducing do-nothing over those inducing predation, as condition (51) implies. Of course, a commitment to do-nothing requires a very high debt level. Intuitively, if there is an active acquisition market following predation attempts, the incumbent must concern himself with the influence he has on auction prices. To minimize price impact, he must choose very high debt levels.

6. Empirical Implications

The main argument in this paper is that the leverage of an incumbent can discourage entry due to the negative effect that shallow pockets have on exit (trade sale and liquidation) prices. In turn, the decline in exit prices is predicted to exacerbate the financing constraints faced by entrants. In addition, we argued that in order for the shallow pockets strategy to be effective, the incumbent should rely upon public debt. Finally, we predict that the shallow pockets strategy is best suited for value firms looking to protect short-term economic rents.

6.1 *Tested Implications*

We begin by discussing empirical evidence relating to the main elements of the causal mechanism proposed in our paper. First, we note that the recent study by Benmelech, Garmaise and Moskowitz (2005) confirms a positive relationship between exit prices and the debt capacity of entrants. In particular, they find that when a real estate development has greater redeployability (less restrictive zoning regulations), the project supports larger loan balances and longer debt maturity.

Second, existing research supports the argument that financiers can expect higher exit prices when incumbents have deep pockets. Consider first the evidence on recoveries in the event of business failure. Acharya, Bharath and Srinivasan (2006) find that recovery ratios on defaulted debt are lower in heavily levered industries. In addition, they document that the effect is more pronounced for

concentrated industries— highlighting the role of incumbent financial structure. Empirical work on firesales 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).

Third, there appears to be a close connection between the terms of credit and the financial structure adopted by *other firms*. Newman and Rieron (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. It is worth stressing that such a finding contradicts the notion that deep pockets deter entry.

An even more focused testable implication of our model is that deep-pocketed incumbents will pay more for acquisitions than shallow-pocketed acquirers. In our model, deep-pocketed incumbents always win bidding wars, but also drive up prices in the process. Lang, Stulz and Walkling (1991) find that bidder returns are negatively related to the cash flow of the bidder, implying that acquirers with high free cash flow tend to pay more for targets. Schlingemann (2004) also documents the same negative correlation between cash flow and bidder gains, particularly for firms without growth opportunities.

According to our theory, the acquisition strategy of firms depends on their market position and their financial structure. Our model predicts that deep-pocketed incumbents will more frequently appear as buyers in acquisitions than their shallow-pocketed counterparts. There is indeed substantial evidence in support of this prediction. Hay and Liu (1998) find that firms in industries with dominant firms tend to rely more on external growth compared to internal growth, and that this tendency is particularly pronounced among the dominant firms themselves. They report that various measures of free cash flow are significant explanatory variables for the propensity of firms to launch acquisitions. They find this tendency to be particularly strong in firms that dominate their

industry, as predicted by our model. Similarly, Harford (1999) documents that firms with large cash reserves are more likely to make acquisitions and to increase acquisition spending. Kim (2003) finds that mergers are more likely to occur in industries with high cash flows. Andrade and Stafford (2004) find that within a given industry, acquirers will be the firms with high excess debt capacity and large returns. Powell and Yawson (2005) find that merger activity is positively related to free cash flow available in the industry.

Notably, the presence of deep-pocketed incumbents raises the acquisition expectation for rivals and potential entrants, according to our model. There is evidence that the financial flexibility of incumbents translates not only into more intensive merger activity in the industry, but also higher expected gains in acquisitions for *other* firms. Akhigbe and Madura (1999) report that industry rivals exhibit larger stock price increases after merger announcements if the firms in the industry have large cash flows.

The effect of incumbent leverage on market entry in our model is more complex. A moderate increase in leverage leads to less entry, as it reduces acquisition prices but maintains the attractiveness of predation, but a drastic increase of leverage will have the opposite effect, by shifting the incumbent response from predation to do-nothing. Campello (2006) presents evidence that appears to lend some support to our predictions, by showing that moderate debt leads to a more competitive incumbent policy whereas high levels of debt reduce competitiveness. The findings that firms adopting very high leverage levels in LBOs or leveraged recaps (notably Chevalier, 1995b; Khanna and Tice, 2005) are exposed to more entry are consistent with the second prediction.

Consider next the evidence on firms' choice of debt levels and debt composition. Concerning debt structure, 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 only public debt can be used as a commitment device for firms seeking to protect economic rents. We here note that the free cash flow theory of Jensen (1986) also points to public debt as being preferable for a mature company seeking

to constrain capital expenditures. As argued in the introduction, free cash flow theory cannot explain why an empire building CEO would saddle his firm with debt in the first place. In contrast, in our model the CEO takes on debt willingly. In this respect our theory complements Zwiebel (1996), but Zwiebel predicts debt for possible takeover targets with poor investment opportunities, whereas we predict leveraging for dominant firms that are potential acquirers, a prediction that is easier to reconcile with the stylized fact that firm size is positively related to leverage (Rajan and Zingales, 1995; Booth et al., 2001).

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 Proposition 1 stating that a leveraged posture 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.

6.2. Untested Implications

The model generates a number of implications that have not yet been tested. First, we predict that the level of entrepreneurial (entry) activity in a sector or line-of-business should be positively related to the financial slack held by the incumbent. In fact, this prediction is based upon two arguments. From the perspective of the potential entrant, the deep pockets of an incumbent serve to encourage entry since exit prices are higher. From the perspective of the incumbent, the existence

of a large number of entrepreneur-inventors will suggest that entry is always going to occur. If an industry is buzzing with entrepreneurial activity, an incumbent will rationally conclude that some entry will take place and that it is best to maintain the ability to make acquisitions ex post.⁹

Our model predicts incumbent leverage in situations in which it has an effect on entry. Conditions under which such situations arise are not clearly correlated with variables such as investment opportunities, tangible assets or profitability. One needs to account for industry structure and entry risks before deriving predictions from our model. For example, an untested prediction following from Proposition 1 is that incumbents should be more likely to adopt deep pockets when sunk costs of entry are negligible, since the probability of entry is one regardless of their financial structure. When entry costs are low, attempts to deter entry are unlikely to succeed. In this case, the incumbent is better off maintaining a cash reserve to fund acquisitions. The opportunity to deter entry is expected to vary considerably over the industry life cycle, with entry costs in very young industries presumably too low for successful entry deterrence but rising to levels that make a shallow pockets posture attractive as industries consolidate. A similar argument applies if financial barriers to entry are low, for example if entrants have large tangible asset values, or if their capital assets are easy to redeploy in other sectors should entry fail. Entrants would then be expected to have high leverage ratios, but since their assets have higher liquidation values, Proposition 1 predicts a low debt level for the incumbent.

Another untested prediction of the model is that entrants' financial constraints are less severe when industry incumbents maintain deep pockets; entrants should then be able to grow faster and exhibit, on average, weaker indices for the presence of such constraints. Again, the study by Newman and Rierson (2004) does offer indirect evidence on this front, showing that costs of debt capital are increasing in rival firms' leverage.

A final untested implication of our model is that expenditures on predatory activity, e.g. advertising, should have an inverted U-shape in leverage. This is because unlevered firms prefer acquisition

⁹Gompers, Lerner and Scharfstein (2005) examine the determinants of entrepreneurial spawning. However, they do not use incumbent leverage as an explanatory variable.

activity and heavily levered firms prefer passivity. According to our theory, intermediate leverage offers the most credible precommitment to predation.

7. 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 both the resources and incentive to buy the entrant's assets in bankruptcy auctions or trade sales. In some cases, this positive effect on exit values may be sufficient to tilt the balance in favor of entry. In this paper, we illustrated the existence of such an effect using a simple contracting model with endogenous price determination in secondary asset markets. The model highlights the trade-offs associated with the choice between deep and shallow pockets. Deep-pocketed incumbents retain the financial slack needed to make strategic acquisitions. However, this financial posture causes them to indirectly subsidize their future competitors.

The more general message to be taken away from this paper 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

Lemma 3. *In the baseline model, the optimal incumbent financial structure entails debt commitments such that willingness-to-pay is weakly less than ℓ or strictly greater than $y \max\{\alpha, 1\}$.*

Proof. Suppose first $\alpha < 1$. Let WTP denote the incumbent's willingness-to-pay for the entrant as of time t_2^- . The first two postures entered in Table A.1 indicate ownership and values under deep and shallow pockets, respectively. The third listed posture yields a lower payoff for A than shallow pockets since it yields the same ownership structure (and hence profit) in t_2 but increases the value of assets under financier ownership and the likelihood of entry. The fourth listed posture yields a lower payoff for A than deep pockets since v^* and the entry probability are the same, but A does not make an acquisition if $M1$ wins the ownership lottery. The same reasoning indicates the last listed posture also yields a lower payoff than deep pockets.

Posture	Manager M1 retains ownership		Financier seizes assets	
	Value x	Owner in t_2	Value p	Owner in t_2
$WTP > y$	y	A	αy	A
$WTP \leq \ell$	y	M1	ℓ	M2
$\ell < WTP \leq \alpha y < y$	y	M1	$= WTP > \ell$	M2
$\ell < \alpha y < WTP < y$	y	M1	αy	A
$\ell < \alpha y < y = WTP$	y	A or M1	αy	A

Table A.1: Asset Valuations and Final Owners ($\alpha < 1$)

Suppose next $\alpha \geq 1$. The following asset values and ownership structures are relevant.

Posture	Manager M1 retains ownership		Financier seizes assets	
	Value x	Owner in t_2	Value p	Owner in t_2
$WTP > \alpha y$	αy	A	αy	A
$WTP \leq \ell$	y	M2	ℓ	M2
$\ell < WTP \leq y \leq \alpha y$	y	M2	$= WTP > \ell$	M2
$\ell < y < WTP < \alpha y$	$= WTP > y$	M2	$= WTP > y$	M2
$\ell < y \leq \alpha y = WTP$	αy	A or M2	αy	A or M2

Table A.2: Asset Valuations and Final Owners ($\alpha \geq 1$)

The third and fourth listed postures yield lower payoffs than shallow pockets since they have no effect on ownership in t_2 but do increase the financier's return and the likelihood of entry. The final listed policy yields a lower payoff than deep pockets since it has no effect on financier returns (and the likelihood of entry), but does preclude a sure acquisition in the event of entry. ■

Proof of Proposition 2. The proof is established by the following sequence of lemmas.

Lemma 4. *There is a unique $D_1 \in (\Pi_L, \Pi_H)$ such that do-nothing is preferred to acquisition ex post if and only if $D > D_1$.*

Proof. We know

$$D \leq \Pi_L \Rightarrow \Omega_A(D) - \Omega_N(D) = \Delta\bar{\Pi}_2 - y > 0 .$$

and

$$\Omega_A(\Pi_H) - \Omega_N(\Pi_H) = -y.$$

Further

$$D \in (\Pi_L, \Pi_H) \Rightarrow \Omega'_A(D) - \Omega'_N(D) = G(D) - H(D) < 0. \blacksquare$$

Using, Lemma 4, the following lemma establishes the point of indifference between all three options.

Lemma 5. *If $(\phi, D) = (\theta y, D_1)$, the incumbent is indifferent ex post between acquisition, predation and do-nothing.*

Proof. Lemma 4 establishes indifference between N and A at D_1 . The claimed result then follows from equation (25). ■

Consider next the choice between P and A . We proceed stepwise for different regions of ϕ , and begin with the case when ϕ is sufficiently small.

Lemma 6. *If $\phi < y - (1 - \theta) \Delta\bar{\Pi}_2$, then predation is preferred to acquisition ex post for all D .*

Proof. Under the stated restriction on ϕ ,

$$D \leq \Pi_L \Rightarrow \Omega_P(D) - \Omega_A(D) = y - (1 - \theta)\Delta\bar{\Pi}_2 - \phi > 0.$$

Further

$$D \in (\Pi_L, \Pi_H) \Rightarrow \Omega'_P(D) - \Omega'_A(D) = (1 - \theta)[H(D) - G(D)] > 0. \blacksquare \quad (52)$$

Consider next higher levels of predation costs, with $\phi \in [y - (1 - \theta) \Delta \bar{\Pi}_2, \theta y]$. For each level of predation costs on this interval, we define a debt function $D_2(\phi)$ as the locus of points (ϕ, D) such that the incumbent is just indifferent between predation and an acquisition. The function $D_2(\phi)$ is defined implicitly by the equation

$$\Omega_A[D_2(\phi)] \equiv \Omega_P[D_2(\phi)]. \quad (53)$$

The following lemma pins down the properties of the schedule $D_2(\phi)$.

Lemma 7. *The debt function $D_2(\phi)$ defining points of (ex post) indifference between predation and acquisition is strictly increasing on its domain $[y - (1 - \theta) \Delta \bar{\Pi}_2, \theta y]$ and satisfies $D_2[y - (1 - \theta) \Delta \bar{\Pi}_2] = \Pi_L$ and $D_2(\theta y) = D_1$.*

Proof. If $\phi = y - (1 - \theta) \Delta \bar{\Pi}_2$, then

$$\Omega_P(\Pi_L) = \bar{\Pi}_2^m - \Pi_L - y = \Omega_A(\Pi_L).$$

From Lemma 5 we know $D_2(\theta y) = D_1$. Finally, application of the implicit function theorem to (53) yields

$$\frac{dD_2}{d\phi} = [(1 - \theta)(H(D_2) - G(D_2))]^{-1}. \blacksquare$$

Consider finally the choice between predation and do-nothing. We define a debt function $D_3(\phi)$ as the locus of points (ϕ, D) such that the incumbent is just indifferent between predation and do-nothing. The function $D_3(\phi)$ is defined implicitly by the equation

$$\Omega_P[D_3(\phi)] \equiv \Omega_N[D_3(\phi)]. \quad (54)$$

The following lemma which pins down the properties of the schedule $D_3(\phi)$.

Lemma 8. *The debt function $D_3(\phi)$ defining points of (ex post) indifference between predation and do-nothing is strictly decreasing on $[0, \theta y]$ and satisfies $D_3(0) = \Pi_H$ and $D_3(\theta y) = D_1$.*

Proof. If predation costs are zero, indifference can only be maintained if there is zero chance of survival. The fact that $D_3(\phi)$ is decreasing follows from applying the implicit function theorem to equation (54). The last part of the claim follows from Lemma 5. \blacksquare

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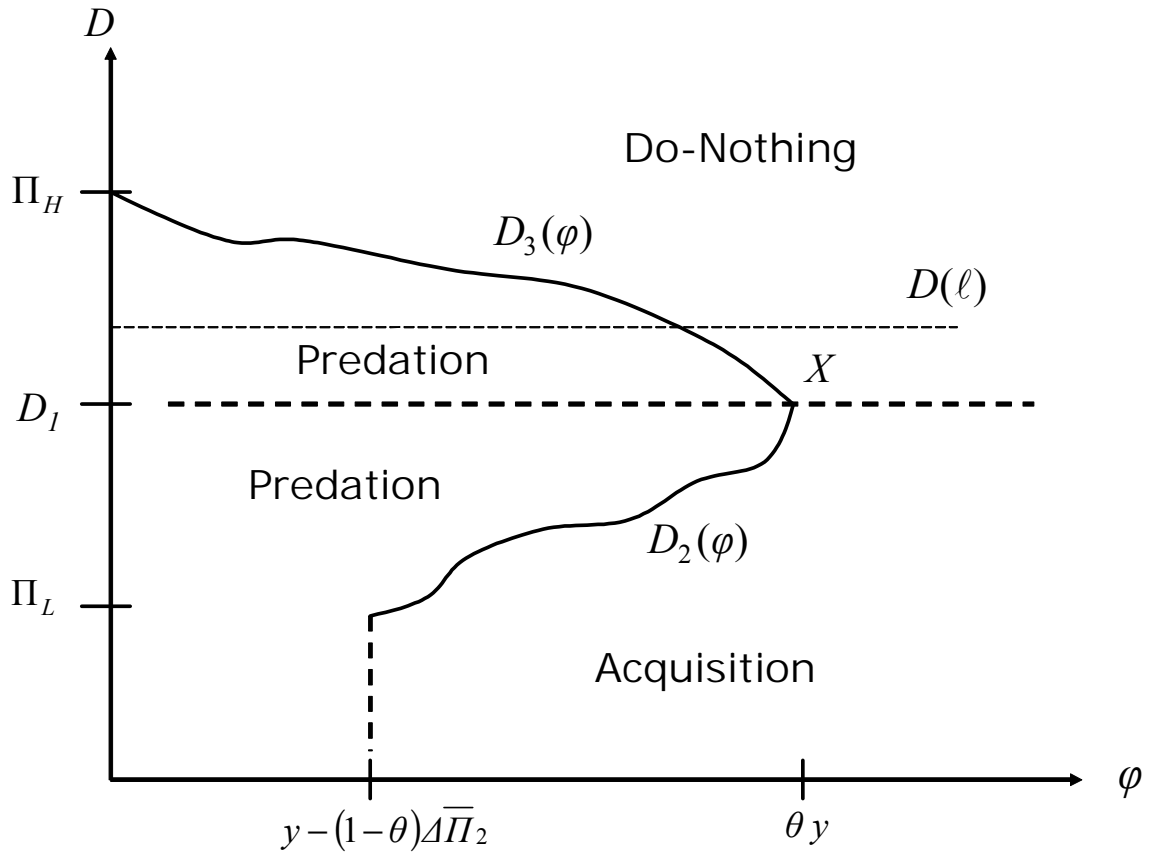


Figure 3: Choice Between Predation, Acquisition and Do-Nothing

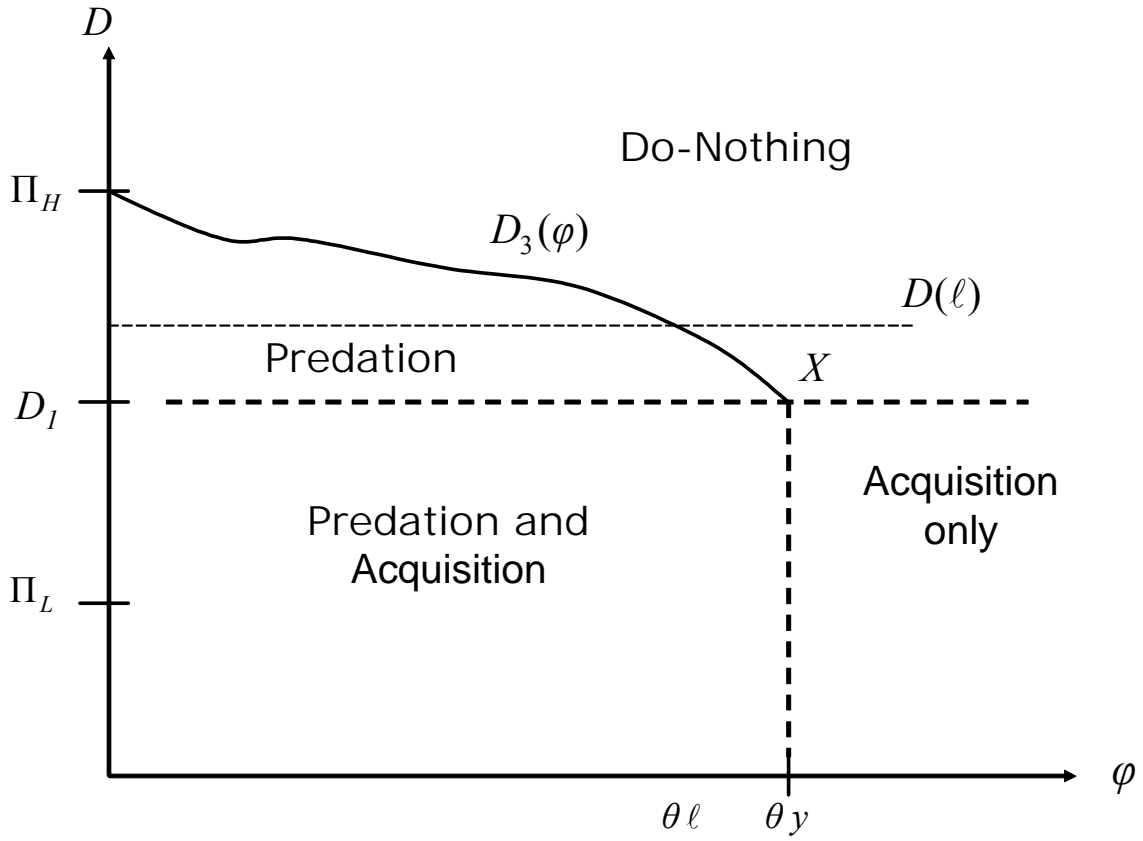


Figure 4: The Choice between Predation and Do-Nothing Followed by a Choice Between Acquisition and Do-Nothing