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Pledgeability, Industry Liquidity, and Financing Cycles

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ABSTRACT

Why do firms choose high debt when they anticipate high valuations, and underperform subsequently? We propose a theory of financing cycles where the importance of creditors' control rights over cash flows ("pledgeability") varies with industry liquidity. The market allows firms take on more debt when they anticipate higher future liquidity. However, both high anticipated liquidity and the resulting high debt limit their incentives to enhance pledgeability. This has prolonged adverse effects in a downturn. Because these effects are hard to contract upon, higher anticipated liquidity can also reduce a firm's current access to finance.

WHY DO DOWNTURNS FOLLOWING EPISODES OF HIGH firm valuations result in more protracted recessions (see Krishnamurthy and Muir (2017), López-Salido, Stein, and Zakrajšek (2017))?[1] One traditional rationale is based on the idea of "debt overhang"—debt built up during the boom restricts investment and borrowing during the bust. However, if everyone knows that debt reduces investment, debt holders have an incentive to write down the debt in return for a stake in the firm's growth. For debt overhang to be a serious concern, the firm and debt holders must be unable to negotiate value-enhancing contracts. Another view is that borrowers cannot be trusted to pursue only value-enhancing investments, even in a downturn, in which case debt overhang is needed to constrain the borrower's investment—overhang is a second-best solution to a

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[1] Krishnamurthy and Muir (2017) document a negative correlation between precrisis spreads and credit growth, as well as a positive correlation between the change in spread as the crisis hits and the severity of the subsequent crisis. López-Salido, Stein, and Zakrajšek (2017) show that narrow credit spreads predict a slowdown in real activity in subsequent years, including in GDP growth, investment, consumption, and employment.

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fundamental moral hazard problem (see Hart and Moore (1995) or Shleifer and Vishny (1992)). The immediate questions raised by the latter view is why would we want to constrain borrowers more in bad times following high valuations, when the constraints imposed by debt are already high, and why would the moral hazard problem be so much more serious in such episodes.

In this paper, we provide an explanation for high debt and show why its consequences are more acute following periods of high valuations and rational optimism about future values. In doing so, we differentiate between financier control rights that are due solely to high resale prices for assets and control rights that derive from pledging cash flows. The former are especially useful in enforcing claims during an asset price boom, whereas the latter facilitate enforcement of external claims at other times, including downturns. The transition between regimes in which the importance of control rights associated with cash flows differ significantly causes the debt built up during a boom to have prolonged adverse effects during a downturn.

To be more specific, consider an industry that requires special industry knowledge to produce. Within the industry, there are firms run by incumbents, there are experts (those who know the industry well enough to be able to run firms as efficiently as the incumbents), and there are industry outsiders (such as financiers who do not know how to run industry firms but have general managerial/financial skills).

Financiers have two sorts of control rights: control through the right to repossess and sell the underlying asset being financed if payments are missed, and control over the cash flows generated by the asset. The first right only requires the frictionless enforcement of property rights in the economy, which we assume. This right is particularly valuable when a large number of capable potential buyers are willing to pay a high price for the firm's assets. Greater wealth among experts (which we term *industry liquidity*) increases the availability of this *asset-sale-based* financing. Because we analyze a single industry, high levels of this industry liquidity can be interpreted as an economy-wide boom.

The second type of control right is conferred on creditors by the firm's incumbent manager as she makes the firm's cash flows more appropriable by, or pledgeable to, creditors over the medium term. For example, she could improve accounting quality or set up escrow accounts so that cash flows are hard to divert. In general, an increase in experts' higher prospective wealth (that is, liquidity) as well as in their ability to borrow against the future cash flows of the firm they buy (that is, pledgeability) will increase their bids for the firm. In turn, higher prospective bids will increase debt recovery, and thus the willingness of creditors to lend up front. It therefore follows that *higher liquidity and pledgeability increase the firm's debt capacity*.

However, pledgeability is endogenously determined. Consider the incentives of an incumbent firm manager while choosing cash flow pledgeability for the next period. We assume that she may sell some or all of the firm next period with some probability, either because she is no longer capable of running it or because she needs to raise capital for new investment. If she owned the firm and had no debt claims outstanding, she would undoubtedly want to increase pledgeability, especially if the direct costs of doing so are small—this would simply increase the amount that she would obtain by selling the firm to experts if she lost ability to run the firm. If she has taken on debt, however, enhancing *cash flow pledgeability* is a double-edged sword. Higher bids from experts also allow existing creditors to collect more if the incumbent stays in control because creditors have the right to seize assets and sell them when not paid in full. In such situations, the incumbent has to "buy" the firm from creditors by outbidding experts (or paying debt fully). The higher the probability that she retains ability and stays in control, and the higher the outstanding debt, the lower her incentives to raise pledgeability. *Higher outstanding debt thus reduces the incumbent manager's incentives to raise pledgeability.*

Now consider the effect of industry liquidity on pledgeability choice. If experts are rational, they will never pay more for the firm than its fundamental value. When future industry liquidity is very high, experts will have enough wealth to buy the firm at full value without needing to borrow more against the firm's future cash flows. If so, higher pledgeability has no effect on how much experts will bid to pay for the firm. In other words, *high future liquidity crowds out the need for pledgeability* in enhancing debt repayments. We therefore have two influences on pledgeability—the level of outstanding debt and the anticipated liquidity of experts. The key results of the paper stem from the interaction between the two.

To see this, consider a prospective boom, which is anticipated with high probability, during which experts will have plenty of wealth. Repayment of any corporate borrowing today is enforced by the potential high resale value of the firm—at the future date, wealthy experts will bid full value for the firm as in Shleifer and Vishny (1992), without needing high pledgeability to make their bid. The high anticipated resale value increases the promised payment that a firm can credibly repay and thus the amount it can borrow today (see Acharya and Viswanathan (2011)).

Because pledgeability is not needed to enforce repayment in a future highly liquid state, a high probability of such a state encourages creditors to lend large amounts to the incumbent up front, even though they know that doing so crowds out the incumbent's incentives to enhance pledgeability, and even if there is a possible low liquidity state in which pledgeability is needed to enhance creditor rights. *Prospective liquidity thus encourages borrowing, which can crowd out pledgeability.* Consequently, if the low-liquidity state is realized, the enforceability of the firm's debt, as well as its borrowing capacity, will fall significantly because pledgeability has been set low. Experts, also hit by the downturn, no longer have much personal wealth, nor does the low-cash-flow pledgeability of the firm allow them to borrow against future cash flows to pay for the firm. The adverse effect of anticipated liquidity on pledgeability via higher leverage is a key new focus of this paper.

Because external claims are high in these low-liquidity episodes, the firm may be sold to outsiders. Although industry outsiders have little ability to operate the firm themselves, this may be a virtue—outsiders have strong incentives to improve cash flow pledgeability because they do not want to own the firm long term, but rather want to sell the firm back to experts at a high price. Outsiders play a critical role, therefore, not because they are flush with funds, but because they are not subject to moral hazard over pledgeability in the face of substantial debt.

Importantly, creditors have little incentive to renegotiate fixed debt claims down during a downturn, because reallocation of the firm to industry outsiders may be the outcome that maximizes their claims, given past pledgeability choices. Consequently, in a downturn following a boom, a larger number of the new asset owners will be less-productive industry outsiders, reducing average productivity. Eisfeldt and Rampini (2006, 2008) provide evidence consistent with this argument.

Eventually, as the economy recovers, the outsiders sell the assets back to the more productive experts, as their higher pledgeability increases experts' ability to raise money against future cash flows. Recoveries following an asset price boom and high leverage are thus delayed, not just because debt has to be written down—where frictions in writing down debt would increase the length of the delay—but also because firms have to restore the pledgeability of their cash flows to cope in a world in which liquidity is scarcer. It is the need to raise pledgeability that may prolong the downturn. Higher anticipated liquidity in some future states can therefore induce more eventual misallocation in less liquid states, a spillover effect between states that operates through leverage and pledgeability! Importantly, we will show that, through its effect on leverage and pledgeability, higher anticipated liquidity can *reduce* the amount of funding that can be raised up front.

All this suggests a financing cycle in the amount of leverage available to firms. In booms, when high future resale prices (as opposed to fire-sale prices) for assets are likely, financial markets allow firms to raise more with extremely high promised debt repayment. Such booms can be followed by busts, with the ability to raise debt financing lower than normal because pledgeability was previously set low. The economy need not oscillate only between booms and busts. In normal times, when anticipated liquidity is lower than that prevailing in booms, the credit market will naturally limit the amount that an incumbent promises, so as to ensure that she has incentives to keep pledgeability high. Indeed, firms will be able to raise more with moderate promised payments than with very high promised payments. Effectively, the financial market provides a lower leverage limit at such times.

The leverage overhang on the pledgeability choice resembles traditional debt overhang (Myers (1977)), whereby decisions of equity-maximizing managers, such as investment, are distorted when they cause an increase in the value of outstanding debt. The pledgeability decision that we model is similarly distorted because while benefiting the incumbent by raising the firm's resale value, it also helps creditors collect payments.

Our model is also related to Jensen (1986). In Jensen (1986), leverage alone is sufficient to get managers to pay out free cash flow. Instead, we argue that the extent of "free" cash flow is endogenous, with one of the effects of high debt being that firm managers tunnel even more cash flow out of the firm, thus "freeing" it for themselves. As Jensen (1989) argues, and our model suggests, the prospective future sale of the firm in management buyouts may be what is needed to incentivize management to not tunnel.

Our paper is most closely related to Shleifer and Vishny (1992) and Eisfeldt and Rampini (2008), as we discuss in Section I where we lay out the model. Our paper also explains why asset price booms based on a combination of liquidity and leverage can be fragile (see, for example, Borio and Lowe (2002), Adrian and Shin (2010), and Rajan and Ramcharan (2015)), and offers a reason why credit cycles emerge, though a dynamic extension to the model is needed to explain the properties of such cycles fully (see, for example, Kiyotaki and Moore (1997)).[2] More broadly, our paper provides theoretical underpinnings for financing cycles (Borio (2014)), where a simultaneous and sustained increase in asset prices and leverage could significantly increase the persistence of business cycle downturns.

The rest of the paper is organized as follows. In Section I, we describe the basic framework and the timing of decisions in a two-period model, and in Section II we provide two motivating examples. Section III proceeds with the formal analysis on pledgeability choices when financing is provided via debt contracts. The maximum amount that can be pledged to outside investors is characterized, and the fundamental trade-offs in the model are explained. We discuss robustness of the model to alternative assumptions in Section IV, and empirical implications and the relationship to the literature in Section V. Finally, in Section VI we conclude.

I. The Framework

A. The Industry and States of Nature

Consider an industry with three dates (0, 1, and 2) and two periods between these dates, with date t marking the end of period t. A period is a phase of the financing cycle (see Borio (2014), for example), which extends over several years. At the beginning of each period, the state of the industry is realized. The industry can prosper in good state G with probability q, or can be distressed in bad state B with probability of $1 - q$. In period 2, we assume that the industry returns to state G for sure—this is meant to represent the long-run state of the industry (we model economic fluctuations but not apocalypse). Figure 1 illustrates the possible states of nature.

B. Agents and the Asset

There are two types of agents in the economy. *Expert* (E) managers have high ability to produce with an asset, which we call the firm. Some mutual

[2] See Benmelech and Bergman (2011), Coval and Stafford (2007), and Shleifer and Vishny (2011) for comprehensive reviews.

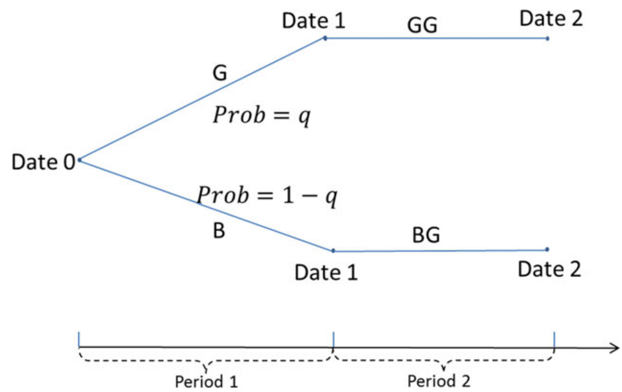

Figure 1. States of nature. (Color figure can be viewed at wileyonlinelibrary.com)

specialization is established over the period between the incumbent expert manager and the firm, which creates a value to incumbency. Therefore, when the state is G, only the expert manager in place at the beginning of that period t can produce cash flows C_t with the asset over the period. In the B state, however, even an expert manager cannot produce cash flows. There are also inexpert *industry outsiders* who are low-ability (L) managers. They cannot produce cash flows regardless of the state. *Financiers* can be thought of as low-ability managers who have funds to lend provided they break even. All agents are risk neutral. We ignore time discounting, which is just a matter of rescaling the cash flows.

A high-ability expert manager retains her ability into the next period with probability $\theta < 1$, otherwise she turns into a low-ability manager. Think of θ as the degree of firm stability. Intuitively, the critical capabilities for success are likely to be stable in a mature firm, or in a firm in an industry with little technological innovation. However, in a young firm that has yet to settle into its strategic niche or in an industry with significant innovation, the critical capabilities for success can vary over time—a manager who is appropriate in a particular period may be ineffective in the next. This is the sense in which an incumbent can lose ability, which occurs with higher probability in a young firm or a changing industry. As we will see later, an alternative interpretation is that $(1 - \theta)$ is the probability of arrival of an investment opportunity or a funding need. Stability θ under that interpretation would be the degree to which the firm has no future funding needs.

The incumbent's loss of ability in the next period becomes known to all shortly before the end of the current period. Loss of ability is not an industry-wide occurrence and is independent across managers. So, even if a manager loses her ability, a large number of other experts are equally able to take her place next period. If a new expert takes over at the end of the current period, she will shape the firm according to her idiosyncratic management style, producing cash flows with the firm's assets in future periods in good states. A manager's (both the incumbent and other bidders) type next period is observable but not verifiable and hence cannot be written into contacts.

C. Financial Contracts

A manager can raise money from financiers against the asset by writing one-period financial contracts. We focus on debt contracts, with promised payments at the end of period t denoted by D_t, for most of our analysis. We can justify this by assuming that the aggregate state s_t is observable but not verifiable. Below we will discuss how the analysis changes when the aggregate state s_t is verifiable and contracts can be state-contingent.

Having acquired control of the firm, the incumbent manager would like to keep the realized cash flow for herself rather than share it with financiers. Two types of financier control rights force the manager to repay the external claims. First, the financier automatically gets paid the *pledgeable* portion of the cash flow produced over the period, up to the amount of the financier's claim. Second, just before the end of the period, the financier has the right to seize and auction the firm to the highest bidder if he has not been paid in full. As in Hart and Moore (1994), giving financiers this right in case of default can induce the borrower to pay more than the pledgeable cash flow this period. Below, we describe these two control rights in more detail.

D. Control Rights Over Cash Flow: Pledgeability

Let us define cash flow *pledgeability* as the fraction of realized cash flows that are automatically directed to an outside financier. The incumbent chooses pledgeability this period. It is then embedded next period, and persists for the entire period. Thus, *pledgeability* γ_{t+1} set in period t is the fraction of period $t+1$'s cash flows that can be automatically paid to outside financiers. The range of feasible pledgeability levels is $\gamma_{t+1} \in [\underline{\gamma}, \bar{\gamma}]$, where $\underline{\gamma}$ and $\bar{\gamma}$ satisfy $0 \leq \underline{\gamma} < \bar{\gamma} \leq 1$. In general, the range of feasible pledgeability levels is determined by the institutions supporting corporate governance (such as regulators, investigative agencies, laws, and the judiciary). Setting $\gamma_{t+1} > \underline{\gamma}$ costs $\varepsilon \geq 0$. We present our results primarily for the case in which $\varepsilon \to 0$; positive ε only alters the results quantitatively. Although any level of pledgeability between $\underline{\gamma}$ and $\bar{\gamma}$ is feasible, in equilibrium the incumbent will choose either $\gamma_{t+1} = \underline{\gamma}$ or $\gamma_{t+1} = \bar{\gamma}$ because, as will be clear shortly, the incumbent's payoff is always linear in pledgeability γ_{t+1}.

A manager can tunnel cash flows out of the firm and into her pockets in a number of ways. Increasing pledgeability means closing off tunnels for cash flows generated by a future manager. For example, by moving to a simpler corporate structure today, or by making contracts with suppliers more transparent with stricter rules on dealing with related parties, the incumbent ensures that future cash flows cannot be diverted to some nontransparent entity (see, for example, Rajan (2012)). By improving the quality of the accounting systems in place, including the detail and timeliness of disclosures, and by hiring a reputable auditor, the incumbent restricts the scope for future managers to play accounting games to hide cash flows. Any rapid shift from transparent accounting procedures to less transparent procedures, or from a reputable auditor to a less reputable auditor, would be noticed and invite closer scrutiny, defeating the objective of tunneling. Similarly, by taking on debt with strict financial covenants, such as minimum liquidity ratios, minimum collateral requirements, or sinking fund requirements, the incumbent ensures that the firm is positioned to raise new debt with similar tough covenants when the current debt matures, giving future lenders the confidence that cash flows will not be tunneled. More broadly, any structure that enhances future corporate governance, and cannot be fully reversed quickly, enhances future pledgeability.

Although the laxity of the general governance environment in a country determines $\underline{\gamma}$, the scope for an individual corporation to improve on it determines $\bar{\gamma}$. Note also that while we assume that pledgeability can be fixed for the next period, we do not assume that it is fixed permanently. Over time, accountant quality can decrease when accountants come up for rotation, for example, and as the environment itself changes, new ways of tunneling emerge. Allowing pledgeability to be chosen for only the next period captures the sense of fixity over the medium term but not over the long run.

Although a low-ability incumbent does not have industry-specific managerial ability to generate cash flows, he has general governance capabilities and can set next period's pledgeability. Below we will see that his inability to generate cash flows can sometimes be a benefit.

E. Control Rights Over Assets: Auction and Resale

If creditors have not been paid in full from the pledged cash flows and any additional sum the incumbent voluntarily pays, then they get the right to auction the firm to the highest bidder at date t. One can think of such an auction as a form of bankruptcy. The incumbent manager who has failed to make the full payment may also bid in this auction. Therefore, the incumbent can retain control by either paying off the creditors in full (possibly by borrowing once again against future pledgeable cash flows) or by paying less than the full contracted amount and outbidding other bidders in the auction. The precise format of the auction does not matter, so long as what the incumbent is forced to pay rises with what other bidders are willing to bid. We assume that the incumbent can always bid using other proxies, so contracts that ban the incumbent from participating in the auction after nonpayment are infeasible. Essentially, as in Hart and Moore (1994), we rule out "take-it-or-leave-it" threats from the lender that would allow him to extract all the cash the incumbent has without invoking the outside option of selling the asset to others.

F. Initial Conditions and Wealth

Let ω_1^{I,s_1} and ω_1^{E,s_1}, respectively, be the wealth levels of the incumbent and experts in state s_1, with the latter also termed *industry liquidity*. The wealth

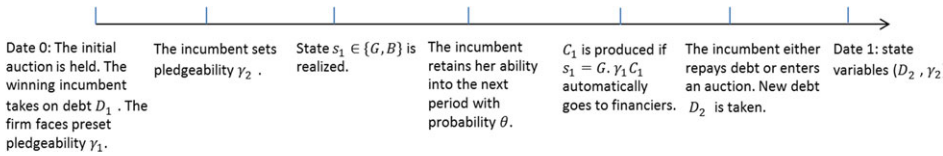

Figure 2. Timing and decisions in period 1. (Color figure can be viewed at wileyonlinelibrary.com)

level of the incumbent is augmented by the unpledged cash flows she generates within the firm $(1 - \gamma_1)C_1$ in state G but not in B, so $\omega_1^{I,G} \geq \omega_1^{I,B}$. We also assume that $\omega_1^{E,G} \geq \omega_1^{E,B}$ because industry prosperity lifts the private income of experts as they work as contractors, consultants, or employees in the industry.

We assume that at date 0, the firm already exists, put together by a founder who has to sell. The reason for this sale is unimportant—the founder may want to retire, may have lost her ability, or may be bankrupt in which case the firm is being sold by the receiver. All that matters is that she sells out entirely and thus wants the highest price. To simplify notation, for now we assume that each bidder must always raise the largest amount from financiers to avoid being outbid. A sufficient condition to guarantee this is that all potential bidders have no wealth at date 0 and compete by promising creditors the largest possible payment that is credible.

G. *Efficiency*

The measure of unconstrained economic efficiency that we use in the rest of this paper is the extent to which the asset is in the hands of the most productive owner at the time. We do not model investment, but instead assume that the asset exists and can be bought by a bidder in an up-front auction. The auction determines the price of the asset and the type of incumbent. An alternative approach, which follows easily from the analysis, is to put a minimum scale on the value of real inputs to be assembled into the firm at date 0, and assume that the firm starts at that date only if enough funding is available to buy those inputs. As a result, inefficient underinvestment may occur if moral hazard (which we analyze shortly) pushes available funds at date 0 below this floor. We illustrate an extreme consequence of this channel later, with an example showing that higher liquidity ex post, working through leverage and lower pledgeability, can actually reduce the amount raised up front.

H. *Timing*

The timing of events is described in Figure 2. After the initial auction, the incumbent takes on debt D_1 that is due at date 1. We assume that the incumbent sets pledgeability γ_2 only knowing the probability of states G and B. Next, the state is realized, and her ability in period 2 is known. Production then takes place and the pledgeable fraction γ_1 of cash flows (set in the previous period) goes to financiers automatically if state G is realized. The incumbent either pays the remaining balance due or enters the auction. The period ends with a new incumbent potentially in place.

II. Two Motivating Examples

In this section, we develop two examples where we illustrate three effects that together constitute the core of our results. First, both high pledgeability and higher anticipated liquidity weakly enhance enforceable debt repayment. Second, higher outstanding debt reduces the incumbent's incentives to set pledgeability high. Third, higher anticipated liquidity reduces the need for high pledgeability in enforcing debt repayment. Taken together, these three effects imply that higher anticipated liquidity may incentivize the incumbent to take so much debt that she neglects pledgeability, but this may be the debt level that allows her to raise the most funding up front. In sum, higher anticipated liquidity enhances leverage and crowds out pledgeability.

Let the parameters for the examples be given as follows: $C_1 = 0$, $C_2 = 1$, $\theta = 0.5$, $\underline{\gamma} = 0.3$, $\bar{\gamma} = 0.6$, $\omega_1^{I,G} = 0.8$, $\omega_1^{I,B} = 0$, $\omega_1^{E,B} = 0$, $\gamma_1 = 0$, $q = 0.8$, and $\varepsilon \to 0$.

EXAMPLE 1: *Low anticipated industry liquidity*: $\omega_1^{E,G} = 0.2$.

Debt repayment at date 1 is enforced by the lender, who can seize the firm and auction it to experts. The incumbent has to either pay the amount due or match the auction price, and will choose to pay the lower of the two, defaulting strategically if the anticipated auction price is less than the promised debt payment. Of course, if the incumbent loses ability, she has no option but to sell in an auction because she cannot run the firm. She will use the auction proceeds to pay debt.

Raising the pledgeability of future cash flows can increase the amount that experts can borrow against the firm and (weakly) increase their bids for the firm's assets. Similarly, higher realized expert wealth or liquidity will also increase expert bids. In state G, an expert can bid using her personal wealth 0.2 and the amount that she can borrow against future cash flows. If period-2 pledgeability has been set high (this is set earlier in period 1 before the state is known), then she can borrow 0.6 times the date-2 cash flow of one and therefore will bid up to 0.8 in total. If pledgeability has been set low, the amount she can borrow against date-2 cash flows falls to 0.3, in which case she can only bid up to 0.5. Similarly, in state B where her wealth is zero, the expert can bid up to 0.6 if pledgeability has been set high and 0.3 if set low. In sum, *higher liquidity and higher pledgeability increase expert bids, and thus enforce greater repayment*. Note that all of these bids fall below 1, the value of the future cash flows from the asset, which means that the asset is underpriced and an expert who acquires the asset will enjoy some positive rents.

Now let us examine the effect of higher debt on the incumbent's pledgeability choice. Consider first an incumbent manager's choice when she owns the entire firm and has no debt due at date 1. In this case, because the incumbent who retains ability pays nothing to retain control of the firm, the pledgeability choice will have no effect on how much she has to pay to remain in control of the firm. On the other hand, if the incumbent manager loses ability and needs to sell the firm, higher pledgeability will increase expert bids by 0.3 and thus the selling price in both state G and state B by 0.3. If the cost of increasing pledgeability is small, as assumed, the incumbent will invariably choose to increase pledgeability.

Consider next the case in which the incumbent manages an identical but highly levered firm with payment of 0.8 due on date 1. In this case, the incumbent does not benefit from high pledgeability when she loses ability, because the proceeds from selling the asset must first be used to repay the outstanding debt. Because expert bids never exceed 0.8 (the bid in state G with high pledgeability), debt consumes all of the auction proceeds. However, because higher pledgeability will increase expert bids by 0.3, it will increase by 0.3 the amount that the incumbent manager has to pay to stay in control when she retains ability. To see this, note that the incumbent can retain control either by fully repaying the outstanding debt of 0.8 or by defaulting strategically and outbidding other experts in the auction (similar to Chapter 11 bankruptcy). High pledgeability increases experts' bids by 0.3 in both states B and G, implying that the incumbent has to pay 0.3 more in either state. Given that she retains ability with probability $\theta = 0.5$, raising pledgeability reduces her expected payoff by 0.15. So with a promised payment of 0.8, she has no incentive to raise pledgeability.

In Section III.B, we formally show that there is a maximum level of date-1 debt payment (between 0 and 0.8) that still leaves the incumbent with incentives to increase future pledgeability. We will see that this intermediate debt payment allows the borrower to commit to pay more to financiers and thus allows them to raise more up front. The point, however, is that *higher debt reduces the incumbent's incentives to raise pledgeability*.

EXAMPLE 2: *High anticipated industry liquidity* $\omega_1^{E,G} = 0.8$.

Suppose now that the anticipated liquidity in state G increases to 0.8. The increased net worth enables the expert to bid up to 1.4 in state G when pledgeability has been set high and 1.1 when pledgeability has been set low. In either case, she will bid no more than 1, the full value of the future cash flows, C_2, generated by the asset. Given that the expert can bid that amount even if pledgeability were set low, higher pledgeability has no effect on the expert bid and hence on debt recovery at date 1 in state G. In effect, *high liquidity crowds out the need for pledgeability*. Ex ante, when the incumbent manager chooses pledgeability in period 1 prior to the aggregate state being realized, her incentives for setting higher pledgeability can come only from state B.

It is easy to see that at the promised date-1 debt payment in state B of 0.45, the incumbent is indifferent between setting pledgeability low or high: When she loses ability, she is able to receive $0.6 - 0.45 = 0.15$ if she had set pledgeability high but gets nothing if she had set it low, whereas when she retains ability, she has to pay 0.45 if she set pledgeability high but only 0.3 if she set it low. The expected benefits and costs balance when promised debt is 0.45, because the probability that she loses ability is 0.5. At any higher promised debt payment, she would set pledgeability low. In sum, when anticipated industry liquidity $\omega_1^{E,G}$ is high, 0.45 is the highest level of debt that incentivizes high pledgeability.

Unlike in Example 1, this incentive-compatible debt level is no longer the debt level that enables the incumbent to commit to pay financiers the most and thus raise the most from them up front. If the incumbent borrows at date 0 by setting date-1 debt payment at one, she will set pledgeability low, fully repay the debt in state G (which happens with probability 0.8), but default in state B, in which case creditors will only recover 0.3. Expecting this, risk-neutral creditors will be willing to extend a risky loan amount of 0.86, with face value 1. By contrast, by setting the face value at 0.45, the incumbent can only borrow 0.45 up front. Thus, *greater liquidity enhances leverage, which crowds out pledgeability*.

III. Solving the Model

We now present the model formally. Because there is a single state in period 2, after which the economy ends, both the high-type expert as well as the incumbent who retains ability can commit only to repay $D_2 = \gamma_2 C_2$ in period 2, where γ_2 is the pledgeability set by the incumbent in period 1. As a result, they can borrow up to $D_2 = \gamma_2 C_2$ when bidding for control at date 1. In Section III.A, we impose parametric assumptions that resemble the industry after a period of sustained prosperity (as in Example 2). We show that if prosperity is likely to continue, high anticipated liquidity supports high leverage and leads to low pledgeability choice. If prosperity does not continue and liquidity falls, access to finance will drop more than proportionally. In Section III.B, we describe the outcomes when the states resemble more normal circumstances. The comparison between prosperity and normal circumstances highlights the effect of anticipated industry liquidity on pledgeability. In Section III.C, the parametric assumptions will describe an industry after a period of distress, when low anticipated liquidity restricts the amount of leverage and encourages high pledgeability choice. The cases in Sections III.A, III.B, and III.C cover all of the possible state-specific situations that could arise.

A. Case 1: The Industry After a Period of Prosperity

In this subsection, we formalize the analysis highlighted in Example 2 with more general parameters. The following parametric assumptions allow us to focus on a case that highlights a key result of the paper.

ASSUMPTION 1:

(a) $\omega_1^{E,G} + \underline{\gamma} C_2 \geq C_2$;
(b) $\omega_1^{E,B} + \underline{\gamma} C_2 < C_2$ *and* $\omega_1^{I,B} \geq \omega_1^{E,B}$.

Assumption 1(a) ensures that in state G, industry liquidity is high enough that experts can afford to pay the full price of the asset even if pledgeability is set as low as $\underline{\gamma}$. Experts have wealth $\omega_1^{E,G}$ and can borrow up to $\underline{\gamma} C_2$. Their maximum bid is therefore $\omega_1^{E,G} + \underline{\gamma} C_2$, which exceeds the full value of the asset C_2. Assumption 1(b) ensures there is limited industry liquidity in the bad state B, so that experts cannot bid the full value of the asset if pledgeability is set low. Meanwhile, the incumbent has more wealth than experts in that state, so she can retain control by outbidding experts in a possible date-1 auction (because pledgeability increases what both parties can borrow by the same amount). The states here, given Assumptions 1(a) and 1(b), represent situations following a time in which the industry has prospered. In state G, prosperity continues into a boom, whereas in state B, prosperity turns to temporary distress. We now solve the model backward, having already determined what happens in period 2.

A.1. Date 1

Consider now the payments and decisions made in period 1. We focus on a high-ability incumbent's incentive in setting pledgeability and how it is affected by the promised payment D_1. We then solve for the maximum amount a high-ability manager can raise, and therefore bid, at date 0.

If state G is realized in period 1, cash $\gamma_1 C_1$ is verifiable and goes directly to the financier (up to the value of the promised claim D_1), where γ_1 is the pledgeability that has been set in period 0. Let us define $\widehat{D}_1^{s_1}$ as the remaining payment due at date 1. Clearly, $\widehat{D}_1^G = D_1 - \gamma_1 C_1$, if $\gamma_1 C_1 < D_1$,[3] and $\widehat{D}_1^B = D_1$. In any date-1 auction for the firm, industry outsiders will not bid to take direct control of the firm because the firm generates no cash flow in the last period and the firm has no residual value. Therefore, to retain control, the incumbent needs to either pay off her debt entirely or outbid experts in the date-1 auction. Next, we show how experts' bids are affected by the incumbent by her choice of pledgeability γ_2.

(1) Experts' Bid

In any auction for the firm held at date 1 in state $s_1 \in \{G, B\}$, experts bid using their date-1 wealth ω_1^{E,s_1} and the amount of future cash flows $\gamma_2 C_2$ that they can borrow against (because the cash flows are pledgeable) at date 1. Therefore, the total amount that they each can bid is $\omega_1^{E,s_1} + \gamma_2 C_2$. Of course, they will not bid more than the total value of future cash flows,C_2. So the maximum auction bid at date 1 is $B_1^{E,s_1}(\gamma_2) = \min[\omega_1^{E,s_1} + \gamma_2 C_2,\ C_2]$. To retain control, the incumbent pays the minimum of the remaining debt or outbids experts. That is, she pays $\min\{\widehat{D}_1^{s_1}, B_1^{E,s_1}(\gamma_2)\} = \min\{\widehat{D}_1^{s_1}, \omega_1^{E,s_1} + \gamma_2 C_2,\ C_2\}$. Clearly, through the choice of

[3] Note that $\widehat{D}_1^G = 0$, if $\gamma_1 C_1 \geq D_1$. For now, we assume that the incumbent always levers up fully so that in equilibrium, $\gamma_1 C_1$ is less than D_1.

pledgeability, γ_2, the incumbent can potentially affect the amount of payment needed for her to stay in control.

Note that higher pledgeability is valuable only if there is *potential underpricing*, a positive difference between the present value of future cash flows accruing to an expert if he buys the firm and the amount that he can bid if the incumbent has set period-2 pledgeability low. The underpricing equals $C_2 - B_1^{E,s_1}(\underline{\gamma}) = \max\{(1-\underline{\gamma})C_2 - \omega_1^{E,s_1}, 0\}$ at date 1. By choosing a higher level of period-2 pledgeability, the incumbent can increase experts' bids from $B_1^{E,s_1}(\underline{\gamma})$, thus reducing underpricing.

(2) Incumbent Bid

The cash that the incumbent has at date 1 is ω_1^{I,s_1} in state s_1. If she retains ability, she can also raise funds against period 2's output, $\gamma_2 C_2$. Therefore, the incumbent can pay as much as $B_1^{I,s_1}(\gamma_2) = \min\{\omega_1^{I,s_1} + \gamma_2 C_2, C_2\}$ to the financier. Comparing $B_1^{I,s_1}(\gamma_2)$ and $B_1^{E,s_1}(\gamma_2)$, we see that the incumbent will outbid experts whenever she has (weakly) more wealth ($\omega_1^{I,s_1} \geq \omega_1^{E,s_1}$), because both parties can borrow up to $\gamma_2 C_2$ if needed. Of course, she will outbid by paying a vanishingly small amount over $B_1^{E,s_1}(\gamma_2)$. The incumbent is always willing to hold on to the asset if she can outbid, because the continuation value of the asset, C_2, is identical for the incumbent and experts.

(3) Pledgeability Choice

Let us now see how the promised remaining payment $\widehat{D}_1^{s_1}$ affects pledgeability choice. Let $V_1^{I,s_1}(\widehat{D}_1^{s_1}, \gamma_2)$ be the incumbent's payoff in state s_1 when she chooses γ_2, given the remaining required payment $\widehat{D}_1^{s_1}$. If state s_1 is known to be realized for sure, the incumbent's benefit from choosing high versus low pledgeability is $\Delta_1^{s_1}(\widehat{D}_1^{s_1}) = V_1^{I,s_1}(\widehat{D}_1^{s_1}, \bar{\gamma}) - V_1^{I,s_1}(\widehat{D}_1^{s_1}, \underline{\gamma})$. Given the probability of the good state being q, the risk-neutral incumbent will choose high pledgeability for any given D_1 if and only if $q\Delta_1^G(\widehat{D}_1^G) + (1-q)\Delta_1^B(\widehat{D}_1^B) \geq 0$. Below, we solve for V_1^{I,s_1} and $\Delta_1^{s_1}$ separately in the different states.

(4) State G—The Continued Boom: Pledgeability Does Not Matter for Repayment (No Potential Underpricing)

Assumption 1(a) guarantees that $B_1^{E,G}(\underline{\gamma}) = \min\{\omega_1^{E,G} + \underline{\gamma} C_2, C_2\} = C_2$. In this state, industry liquidity is sufficiently high that high-ability experts can pay the full price of the asset, even if the incumbent has chosen low pledgeability. Therefore, there is no potential underpricing and raising pledgeability does not change enforceable payments, even while resulting in cost ε. External payments are committed through the high resale price of the asset, and high pledgeability is neither needed nor desired by anyone. No incentive to raise pledgeability can emanate from this state—liquidity crowds out pledgeability.

LEMMA 1: *Given Assumption 1(a) and the remaining payment* $\widehat{D}_1^G \leq C_2$, $V_1^{I,G}(\widehat{D}_1^G, \gamma_2) = C_2 - \widehat{D}_1^G - \varepsilon \cdot 1_{\gamma_2 > \underline{\gamma}}$ *for* $\gamma_2 \in [\underline{\gamma}, \bar{\gamma}]$. *Therefore,* $\Delta_1^G(\widehat{D}_1^G) \equiv -\varepsilon$ *for any* $\widehat{D}_1^G$.

In words, if state G were to occur for sure, the incumbent would lose ε for sure by choosing high pledgeability over low pledgeability. Now consider the incentives arising from state B.

(5) State B—Temporary Distress: Incumbent Can Always Outbid Experts

Assumption 1(b) implies that industry liquidity in state B is limited, so that the firm is *potentially underpriced*, and thus, there are potential rents to high-ability experts in the auction. Moreover, because $\omega_1^{I,B} \geq \omega_1^{E,B}$ and both the incumbent and experts can borrow up to $\gamma_2 C_2$ in the date-1 auction, the incumbent can outbid the experts regardless of her choice of pledgeability. In this case, if the incumbent retains ability, she receives output C_2 but repays $\min\{\widehat{D}_1^B, B_1^{E,B}(\gamma_2)\}$ to stay in control. Her net continuation payoff is $C_2 - \min\{\widehat{D}_1^B, B_1^{E,B}(\gamma_2)\}$. By contrast, if she loses her ability and has to sell the firm at price $B_1^{E,B}(\gamma_2)$, her continuation payoff is $B_1^{E,B}(\gamma_2) - \min\{\widehat{D}_1^B, B_1^{E,B}(\gamma_2)\}$. The incumbent's payoff in state B is thus $V_1^{I,B}(\widehat{D}_1^B, \gamma_2) = \theta(C_2 - \min\{\widehat{D}_1^B, B_1^{E,B}(\gamma_2)\}) + (1-\theta)(B_1^{E,B}(\gamma_2) - \min\{\widehat{D}_1^B, B_1^{E,B}(\gamma_2)\}) - \varepsilon 1_{\{\gamma_2 > \underline{\gamma}\}}$, which is a weighted average of the payoff if she retains her ability and stays in control and the payoff if she loses ability and has to sell the firm. Note that a higher γ_2 (weakly) increases the amount the incumbent has to pay the financier when she retains ability and control, therefore (weakly) decreasing the first term, while it (weakly) increases the amount the incumbent gets in the auction if she loses capability, thus (weakly) increasing the second term. In choosing to increase γ_2, the incumbent therefore trades off higher possible repayments when she *buys* the firm from the lender against higher possible resale value when she *sells* the firm after losing ability. Clearly, she chooses $\gamma_2 = \bar{\gamma}$ if and only if

$$\begin{aligned} &\theta\left(C_2 - \min\left\{\widehat{D}_1^B, B_1^{E,B}(\bar{\gamma})\right\}\right) + (1-\theta)\left(B_1^{E,B}(\bar{\gamma}) - \min\left\{\widehat{D}_1^B, B_1^{E,B}(\bar{\gamma})\right\}\right) - \varepsilon \\ &\quad \geq \theta\left(C_2 - \min\left\{\widehat{D}_1^B, B_1^{E,B}\left(\underline{\gamma}\right)\right\}\right) + (1-\theta)\left(B_1^{E,B}(\underline{\gamma}) - \min\left\{\widehat{D}_1^B, B_1^{E,B}\left(\underline{\gamma}\right)\right\}\right), \end{aligned} \tag{1}$$

where the left-hand side is the incumbent's continuation value if she chooses $\gamma_2 = \bar{\gamma}$, whereas the right-hand side is the continuation value if she chooses $\gamma_2 = \underline{\gamma}$.[4]

[4] Constraint (1) can be equivalently written in terms of primitives:

$$\begin{aligned} &\theta \max\{C_2 - \widehat{D}_1^B, (1-\bar{\gamma})C_2 - \omega_1^{E,B}, 0\} + (1-\theta)\max\{\min\{\omega_1^{E,B} + \bar{\gamma}C_2, C_2\} - \widehat{D}_1^B, 0\} - \varepsilon \\ &\geq \theta \max\{C_2 - \widehat{D}_1^B, (1-\underline{\gamma})C_2 - \omega_1^{E,B}, 0\} + (1-\theta)\max\{\min\{\omega_1^{E,B} + \underline{\gamma}C_2, C_2\} - \widehat{D}_1^B, 0\}. \end{aligned}$$

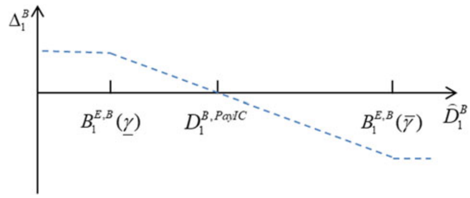

Figure 3. $\Delta_1^B(\widehat{D}_1^B)$ **as a function of** $\widehat{D}_1^B$. (Color figure can be viewed at wileyonlinelibrary.com)

Importantly, a higher outstanding promised remaining payment $\widehat{D}_1^B$ reduces the incumbent's incentives to choose higher γ_2. This result can be easily seen from inequality (1). When $\widehat{D}_1^B \geq B_1^{E,B}(\bar{\gamma})$, the inequality reduces to $\theta(C_2 - B_1^{E,B}(\bar{\gamma})) - \varepsilon \geq \theta(C_2 - B_1^{E,B}(\underline{\gamma}))$, which never holds. In this case, the incumbent always chooses low pledgeability. When $\widehat{D}_1^B \leq B_1^{E,B}(\underline{\gamma})$, however, the inequality reduces to $\theta(C_2 - \widehat{D}_1^B) + (1-\theta)(B_1^{E,B}(\bar{\gamma}) - \widehat{D}_1^B) - \varepsilon \geq \theta(C_2 - \widehat{D}_1^B) + (1-\theta)(B_1^{E,B}(\underline{\gamma}) - \widehat{D}_1^B)$, which always holds. When $\widehat{D}_1^B \in (B_1^{E,B}(\underline{\gamma}), B_1^{E,B}(\bar{\gamma}))$, the inequality reduces to $\theta(C_2 - \widehat{D}_1^B) + (1-\theta)(B_1^{E,B}(\bar{\gamma}) - \widehat{D}_1^B) - \varepsilon \geq \theta(C_2 - B_1^{E,B}(\underline{\gamma}))$ so that high pledgeability $\gamma_2 = \bar{\gamma}$ is chosen if and only if $\widehat{D}_1^B \leq D_1^{B,\text{PayIC}}$, where $D_1^{B,\text{PayIC}} = \theta B_1^{E,B}(\underline{\gamma}) + (1-\theta)B_1^{E,B}(\bar{\gamma}) - \varepsilon$. Superscript "PayIC" indicates that the required payment makes the choice of high pledgeability incentive-compatible. Intuitively, with higher debt, more of the pledgeable cash flows are captured by financiers if the incumbent stays in control, and more of the resale value also goes to financiers if the asset is sold. This is the source of moral hazard over pledgeability.

It is easier to incentivize the incumbent, and thus raise the incentive-compatible level of debt, when the probability $(1-\theta)$ with which she loses skill and has to sell is higher. The following lemma thus holds.

LEMMA 2: *Given Assumption 1(b) and the remaining payment $\widehat{D}_1^B$, it follows that*

$$\Delta_1^B(\widehat{D}_1^B) = \begin{cases} -\theta\left[B_1^{E,B}(\bar{\gamma}) - B_1^{E,B}\left(\underline{\gamma}\right)\right] - \varepsilon & \text{if } \widehat{D}_1^B > B_1^{E,B}(\bar{\gamma}) \\ \theta B_1^{E,B}\left(\underline{\gamma}\right) + (1-\theta)B_1^{E,B}(\bar{\gamma}) - \varepsilon - \widehat{D}_1^B & \text{if } B_1^{E,B}\left(\underline{\gamma}\right) < \widehat{D}_1^B \leq B_1^{E,B}(\bar{\gamma}) \\ (1-\theta)\left[B_1^{E,B}(\bar{\gamma}) - B_1^{E,B}\left(\underline{\gamma}\right)\right] - \varepsilon & \text{if } \widehat{D}_1^B \leq B_1^{E,B}\left(\underline{\gamma}\right). \end{cases}$$

Moreover, $\Delta_1^B(\widehat{D}_1^B) \geq 0$ *if and only if* $\widehat{D}_1^B \leq D_1^{B,\text{PayIC}} = \theta B_1^{E,B}(\underline{\gamma}) + (1-\theta)B_1^{E,B}(\bar{\gamma}) - \varepsilon$.

In Figure 3, we plot $\Delta_1^B(\widehat{D}_1^B)$ against $\widehat{D}_1^B$. For $\widehat{D}_1^B \leq B_1^{E,B}(\underline{\gamma})$, debt repayment is not increased by higher pledgeability because of the low value of outstanding debt. Instead, higher pledgeability only increases outside bids, which is beneficial when the incumbent loses ability and sells the asset. The benefits of high pledgeability are capped at $(1-\theta)[B_1^{E,B}(\bar{\gamma}) - B_1^{E,B}(\underline{\gamma})] - \varepsilon$. As $\widehat{D}_1^B$ rises to $D_1^{B,\text{PayIC}}$, the incumbent has to pay more in expectation to debt holders when she raises pledgeability, so $\Delta_1^B(\widehat{D}_1^B)$ falls to zero and then turns negative as the face value of debt increases further. When $\widehat{D}_1^B > B_1^{E,B}(\bar{\gamma})$, the incumbent has to pay the entire increment in sale price from increasing pledgeability to debt holders when she loses ability—she gets nothing from increasing pledgeability under those circumstances—whereas she has to pay $B_1^{E,B}(\bar{\gamma})$ instead of $B_1^{E,B}(\underline{\gamma})$ if she retains ability. Hence, there is no benefit but only cost to the incumbent by increasing pledgeability, and the expected cost is capped at $\theta[B_1^{E,B}(\bar{\gamma}) - B_1^{E,B}(\underline{\gamma})] - \varepsilon$.

Given $\Delta_1^G(\widehat{D}_1^G)$ and $\Delta_1^B(\widehat{D}_1^B)$, we can check the incumbent's incentives to choose pledgeability for any D_1. Recall that the incumbent will choose high pledgeability if and only if $q\Delta_1^G(D_1 - \gamma_1 C_1) + (1-q)\Delta_1^B(D_1) \geq 0$. Because there is never any incentive to increase pledgeability coming from the future liquid state G, that is, $\Delta_1^G(\widehat{D}_1^G) \equiv -\varepsilon \approx 0$ for any $\widehat{D}_1^G$, the constraint therefore depends on the incumbent's incentive in state B. We thus have the following result.

PROPOSITION 1: *Given Assumptions 1(a) and 1(b), there exists a unique threshold D_1^{IC} such that the incumbent manager sets high pledgeability if and only if $D_1 < D_1^{IC}$. Moreover, as $\varepsilon \to 0, D_1^{IC} \to D_1^{B,\text{PayIC}}$.*

PROOF: Follows directly from Lemmas 1 and 2. ■

(6) The Debt Level That Raises the Most Up Front

Note that $D_1^{B,\text{PayIC}}$ can be written as $D_1^{B,\text{PayIC}} = \theta \min\{\omega_1^{E,B} + \underline{\gamma} C_2, C_2\} + (1-\theta)\min\{\omega_1^{E,B} + \bar{\gamma} C_2, C_2\} - \varepsilon$. Under Assumption 1(b), $D_1^{B,\text{PayIC}}$ is well below $\gamma_1 C_1 + C_2$, the most that can be paid in state G. As a result, D_1^{IC}, the highest level of debt that provides incentives for high pledgeability, keeping in mind both future states, may not be the face value that allows the incumbent to raise the most up front. This is most easily seen when liquidity is plentiful, as in state G with no potential underpricing. In this case, the incumbent can issue debt with face value $\gamma_1 C_1 + B_1^{E,G}(\underline{\gamma}) = \gamma_1 C_1 + C_2$, which she will repay in full in state G, but she will repay only $B_1^{E,B}(\underline{\gamma})$ in state B, because the high face value induces low pledgeability. Even with low pledgeability choice, the incumbent is able to raise $q(C_2 + \gamma_1 C_1) + (1-q)B_1^{E,B}(\underline{\gamma})$ at date 0. In contrast, to incentivize high pledgeability, the promised payment cannot exceed $D_1^{IC} = D_1^{B,\text{PayIC}}$, which will raise $D_1^{B,\text{PayIC}}$ up front. If the difference between $\gamma_1 C_1 + C_2$ and $D_1^{B,\text{PayIC}}$ is large and if the probability of the good state q is sufficiently high, the incumbent could raise more by setting $D_1 = \gamma_1 C_1 + C_2$. The broader point is that the prospect of a highly liquid future state not only makes greater promised payments feasible, but setting payment at this level eliminates incentives to increase pledgeability. To restore those incentives, debt may have to be set so low that funds raised are greatly reduced—something the incumbent will not want to do if she is bidding at date 0 for the firm. Note that this can happen even if the probability of the low state is significant, and even if the direct cost ε of enhancing pledgeability is infinitesimal. Proposition 2 summarizes these results.

PROPOSITION 2: *Given Assumptions 1(a) and 1(b) and $\varepsilon \to 0$, and given D_1^{Max} is the face value of the debt that raises the maximum amount at date 0,*

(a) If $q(C_2 + \gamma_1 C_1) + (1-q)B_1^{E,B}(\underline{\gamma}) > D_1^{B,\text{PayIC}}$, then $D_1^{\text{Max}} = \gamma_1 C_1 + C_2$. For any promised payment $D_1^{B,\text{PayIC}} < D_1 \leq D_1^{\text{Max}}$, $\gamma_2 = \underline{\gamma}$. For any promised payment $D_1 \leq D_1^{B,\text{PayIC}}$, $\gamma_2 = \bar{\gamma}$.

(b) If $q(C_2 + \gamma_1 C_1) + (1-q)B_1^{E,B}(\underline{\gamma}) \leq D_1^{B,\text{PayIC}}$, then $D_1^{\text{Max}} = D_1^{IC} = D_1^{B,\text{PayIC}}$. For any promised payment $D_1 \leq D_1^{\text{Max}}$, $\gamma_2 = \bar{\gamma}$.

Interestingly, high debt will not be renegotiated before, or after, the state s_1 is realized, even if renegotiation is feasible—it will not be renegotiated before because the level of debt is set to raise the maximum amount possible even if it will result in low pledgeability, and it will not be renegotiated after, because relevant parties will not write down their claims given that pledgeability γ_2 has already been set.[5] Both the fixed promised debt payments across states and the act of choosing pledgeability before the state is known have the effect of causing a spillover between anticipated states. An analysis of non-renegotiable debt when pledgeability is chosen after the state is realized is available in the Internet Appendix.[6] The results are similar to those in this section.

A.2. Discussion: The Liquidity Leverage Pledgeability Nexus

We have described the first important result in the paper. If prosperity is likely to continue, liquidity will be high and the credit market will allow high debt. When borrowers finance with high debt, however, they do not have incentives to set pledgeability high, even if the direct costs of doing so are zero and the probability of a low-liquidity state is nonnegligible. Pledgeability is

[5] If the incumbent chooses low pledgeability, then debt repayment will be $B_1^{E,B}(\underline{\gamma})$ in state B because the incumbent defaults and there will be an auction. An interesting issue is, knowing this, would the incumbent not have the incentive to set pledgeability high because $B_1^{E,B}(\underline{\gamma}) < D_1^{B,\text{PayIC}}$? The answer is no. Suppose the incumbent sets pledgeability high with outstanding debt face value $D_1 = \gamma_1 C_1 + C_2$. Then if state B occurs, creditors will not agree to renegotiate D_1 to any level below $B_1^{E,B}(\bar{\gamma})$. Anticipating this, the incumbent would not have incentives to set pledgeability high ex ante. In this case, the incumbent will have an incentive to set pledgeability high only if creditors can commit to renegotiate the debt payment in state B down to some level $D_1 \leq D_1^{B,\text{PayIC}}$, which is tantamount to being able to set state-contingent payments, which we have ruled out.

[6] The Internet Appendix is available in the online version of the article on *The Journal of Finance* website.

neglected, which nevertheless will be acceptable to lenders who anticipate a high probability of continued high liquidity. Liquidity, asset prices (bids in the auction), and leverage follow each other up, whereas pledgeability falls. If prosperity does not continue, and liquidity falls, access to finance will drop significantly. The underinvestment in pledgeability resulting from liquidity-induced leverage cannot be renegotiated away—in competitive markets for assets, the highest bids for the assets when future liquidity is anticipated to be high entail substantial borrowing. Higher anticipated liquidity is therefore not an unmitigated blessing, and can worsen ex post outcomes in less liquid states. Moreover, as we will see shortly, it can reduce the overall amount raised up front. To the extent that government or central bank policies create anticipation of liquidity, these are concerns that have to be kept in mind.

Another way of thinking about anticipated situations of high liquidity is that the prospect of repaying the high level of debt in full is high enough that both borrowers and lenders neglect the loss given default. This can be much more severe than if initial debt were lower, because of neglected pledgeability. As a related aside, when the B state is realized, and debt capacity turns out to be low because of low liquidity and low pledgeability, it might seem as if the incumbent neglected the possibility of that state occurring (see, for example, Gennaioli, Shleifer, and Vishny (2015)). In reality, however, the high level of debt, which is optimally taken on in full knowledge of the prospective states, may crowd out pledgeability. There is thus a spillover between states caused by debt, which may subsequently appear as if particular states were neglected.

A.3. Low-Ability Incumbent Manager

The analysis so far has assumed that a high-ability incumbent manager was in place at date 0. Now consider the bid of a low-ability manager (or equivalently a financier) for the firm at date 0. Clearly, the low-ability manager is always a seller at date 1 (because he cannot produce in period 2), so he sets pledgeability high ($\gamma_2 = \bar{\gamma}$) to maximize the amount that he can sell the firm for. As a result, he sells the firm for C_2 in state G and $B_1^{E,B}(\bar{\gamma})$ in state B. With slightly abuse of notation, we also use D_1^{Max} to denote the face value of the debt that enables a low-ability manager to raise the maximum amount at date 0.

PROPOSITION 3: *If a low-ability manager bids at date 0 and if $\varepsilon \to 0$, then $D_1^{\mathrm{Max}} \to C_2$. For any $D_1 < D_1^{\mathrm{Max}}$, $\gamma_2 = \bar{\gamma}$.*

A.4. Date-0 Auction

Finally, we compare the bids made by high- and low-ability managers during the date-0 auction and determine who will acquire control of the firm. According to Proposition 2, a high-ability manager can borrow up to $\max\{q(\gamma_1 C_1 + C_2) + (1-q)B_1^{E,B}(\underline{\gamma}), D_1^{B,\mathrm{PayIC}}\}$. Together with cash ω_0^E, a high-ability manager bids $B_0^E(\gamma_1) = \omega_0^E + \max\{q(\gamma_1 C_1 + C_2) + (1-q)B_1^{E,B}(\underline{\gamma}),$

$D_1^{B,\mathrm{PayIC}}\}$, provided this is less than $qC_1 + C_2$, the full expected value of the asset. This last condition is assured if ω_0^E is sufficiently small, say, $\omega_0^E = 0$, because both $B_1^{E,B}(\underline{\gamma})$ and $D_1^{B,\mathrm{PayIC}} = \theta B_1^{E,B}(\underline{\gamma}) + (1-\theta)B_1^{E,B}(\bar{\gamma}) - \varepsilon$ are strictly less than C_2. As a result, a high-ability manager always gets rents upon acquiring control, and being constrained in bidding by the amount of liquidity she has, she will always lever up fully at date 0.

A low-ability manager can borrow up to $B_0^L = qC_2 + (1-q)B_1^{E,B}(\bar{\gamma}) - \varepsilon$, which is also what he will bid. Unlike high-ability bidders, he will never augment his bid using his personal wealth because, in expectation, he cannot resell the firm for more than he can borrow. A simple comparison between $B_0^E(\gamma_1)$ and B_0^L shows that a low-ability bidder may win the initial auction when an expert has low initial liquidity ω_0^E with which to bid, there is a low probability q of high industry liquidity at date 1 so the expert bidder knows that setting debt high is dominated, $\gamma_1 C_1$ is low so the expert repays little from the additional cash flows she generates relative to the outsider, and θ is high so the moral hazard in setting pledgeability severely restricts the incentive-compatible amount she can borrow at date 0. Note that a high-ability manager's moral hazard over pledgeability arises because she has the ability to produce—she wants to keep the firm for herself when she retains ability, and hence is likely to be a buyer. In contrast, the low-ability manager is always a seller and does not suffer from such moral hazard.

Acquisition by a low-ability manager is reminiscent of leveraged buyout transactions (see, for example, Jensen (1989)), where firms in stable industries (for which moral hazard over pledgeability is high) are taken over and the revamped management team, which is motivated by the prospect of selling the asset by going public soon, focuses on finding and blocking tunnels—free cash flow that has been eaten up through inefficiency or that has been misappropriated by staff (the proverbial company jet). The management team does not really make fundamental changes to the firm's earning prospects in the time the firm is private, and may not be particularly good at managing the firm, but significantly enhances the pledgeability of future cash flows and thus increases bids for the firm when it goes public. Our model thus suggests that a leveraged buyout is a means to check moral hazard at a time of moderate to low industry liquidity, when pledgeability has been low (poor governance) so that outright takeovers by industry experts are difficult. Furthermore, our model suggests that debt alone is not sufficient, but rather an explicit commitment to sell is important for management to have the right incentives to set pledgeability high. Outright takeovers of such firms are more likely when industry liquidity is higher (voluntary mergers would occur only when there is no underpricing, because our model has no synergies). This is consistent with Harford (2005), who shows that merger waves are more likely after high industry valuations.

(7) Numerical Example (Continued)

The parameters in Example 2 reflect this case when the industry has experienced a period of prosperity. In state G, experts are able to bid $C_2 = 1$ under both high and low pledgeability. We intuited that $D_1^{B,\text{PayIC}}$ was 0.45. This can also be obtained by using the formula $D_1^{B,\text{PayIC}} = \theta B_1^{E,B}(\underline{\gamma}) + (1-\theta)B_1^{E,B}(\bar{\gamma}) - \varepsilon$, where we substitute $B_1^{E,B}(\underline{\gamma}) = 0.3$, $B_1^{E,B}(\bar{\gamma}) = 0.6$, and $\theta = 0.5$. In this case, an expert is able to borrow $q(C_2 + \gamma_1 C_1) + (1-q)B_1^{E,B}(\underline{\gamma}) = 0.86$ by setting debt face value at $D_1 = 1$, but only $D_1^{B,\text{PayIC}} = 0.45$ if the face value is set at $D_1 = D_1^{B,\text{PayIC}}$. Therefore, high anticipated liquidity in state G enhances leverage, which crowds out pledgeability. Interestingly, a low-ability manager can borrow $B_0^L = qC_2 + (1-q)B_1^{E,B}(\bar{\gamma}) - \varepsilon = 0.92$. If the date-0 wealth of experts is below 0.06, then a low-type bidder wins the initial auction.

B. Case 2: Normal Times (as in Example 1)

B.1. Assumption and Equilibrium Outcome

In Section III.A, we studied the industry after a period of prosperity and hence high liquidity. In this subsection, we study the industry during more normal times. We show that under certain conditions, the borrower raises the most by limiting promised debt payment to the level that is consistent with incentives for setting pledgeability high. We impose the following parametric assumptions to replace Assumptions 1(a) and 1(b).

ASSUMPTION 2:

(a) $\omega_1^{E,G} + \bar{\gamma}C_2 < C_2$ *and* $\omega_1^{I,G} \geq \omega_1^{E,G}$;

(b) $\omega_1^{E,B} + \bar{\gamma}C_2 < C_2$ *and* $\omega_1^{I,B} \geq \omega_1^{E,B}$.

Assumptions 2(a) and 2(b) ensure that in both states, increased pledgeability always improves experts' date-1 bids. Furthermore, the incumbent has more liquidity and will outbid experts in an auction in either state.

Now consider the highest level of debt that is consistent with high pledgeability, which we denote by D_1^{IC}. Clearly, D_1^{IC} will lie between $\gamma_1 C_1 + D_1^{G,\text{PayIC}}$, the incentive-compatible level assuming that the G state occurs for sure, and $D_1^{B,\text{PayIC}}$, the incentive-compatible level assuming that the B state occurs for sure. Moreover, because the net benefit from higher pledgeability is decreasing in leverage (see Figure 3), there will be net incumbent benefits from increasing pledgeability if state G occurs (because $D_1^{IC} < \gamma_1 C_1 + D_1^{G,\text{PayIC}}$) and net incumbent costs if state B occurs (because $D_1^{IC} > D_1^{B,\text{PayIC}}$).

In the Appendix, we derive necessary and sufficient conditions for the maximum up-front borrowing by the winning bidder to be incentive-compatible. Proposition 4 summarizes the two conditions.

PROPOSITION 4: *Under Assumptions 2(a) and 2(b) and* $\varepsilon \to 0$, $D_1^{\text{Max}} = D_1^{IC}$ *if (i)* $q < \theta$ *and* $(\gamma_1 C_1 + \omega_1^{E,G}) - \omega_1^{E,B} \leq \frac{1-\theta}{1-q}(\bar{\gamma} - \underline{\gamma})C_2$ *or (ii)* $q \geq \theta$.

PROOF: See the Appendix.

Under the first condition, which requires that liquidity in the two states not be too far apart, $D_1^{IC} \to q(\gamma_1 C_1 + D_1^{G,\mathrm{PayIC}}) + (1-q)D_1^{B,\mathrm{PayIC}}$, the weighted average of the incentive-compatible debt levels. In this case, by setting promised debt higher than D_1^{IC}, the borrower will repay strictly less in both states (because she will set pledgeability low) and thus raise less up front.

The second sufficient condition requires the probability of the good state q to be higher than the probability of the incumbent keeping her ability θ, and effectively limits the moral hazard associated with pledgeability. Intuitively, the benefit of high pledgeability in the good state is realized when the incumbent loses ability, which occurs with unconditional probability $q(1-\theta)$, whereas the cost in the bad state is realized when the incumbent keeps her ability, which occurs with probability $(1-q)\theta$. If $q(1-\theta) > (1-q)\theta$, so that the benefit in the good state dominates the cost in the bad state, the incumbent would never want to violate the pledgeability constraint by taking on too much debt.

(8) *Numerical Example* (Continued)

The parameters for Example 1 reflect normal times. We can follow the same steps to calculate $D_1^{G,\mathrm{PayIC}} = 0.65$. In this case, $D_1^{IC} = 0.6125$ is the maximum debt level that still incentivizes high pledgeability, and is also the payment level that allows the incumbent to raise the most up front. She can repay 0.6125 in the G state and 0.6 in the B state, so she raises 0.61 because the probability of the G state is 0.8. In contrast, any debt level above 0.6125 will induce low pledgeability, so the incumbent will default strategically in both state G and state B, only repaying the amount that experts bid (0.5 in G and 0.3 in B). As a result, she can only raise 0.46 at date 0.

B.2. The Effect of Anticipated Liquidity on Pledgeability and Access to Finance

The assumptions in Section III.A and in this subsection differ in the amount of liquidity assumed in the future states $\omega_1^{E,G}$ and $\omega_1^{E,B}$. We now combine the results from both subsections with the above parameters to see how optimal leverage, pledgeability, and up-front borrowing vary as $\omega_1^{E,G}$ increases from a low level. An increase in the amount of industry liquidity in the G state can eventually reduce both the level of debt consistent with incentives to increase pledgeability and the amount that the incumbent can raise from financiers. We continue to assume that the incumbent's liquidity ($\omega_1^{I,G} = 0.8$) always (weakly) exceeds the expert's liquidity.

In Figure 4, we plot how D_1^{IC}, D_1^{Max}, γ_2, and maximum up-front borrowing vary with anticipated liquidity $\omega_1^{E,G}$. Initially, when $\omega_1^{E,G}$ is low ($\omega_1^{E,G} < 0.4$), the maximum debt level that still incentivizes high pledgeability, D_1^{IC}, increases with $\omega_1^{E,G}$ (with slope $q = 0.8$). Intuitively, when there is underpricing in states G and B even with high pledgeability, an increase in pledgeability increases the committed payout in future states G and B by the same amount $(\bar{\gamma} - \underline{\gamma})C_2$. In this case, a small increase in future industry liquidity, for example, in state

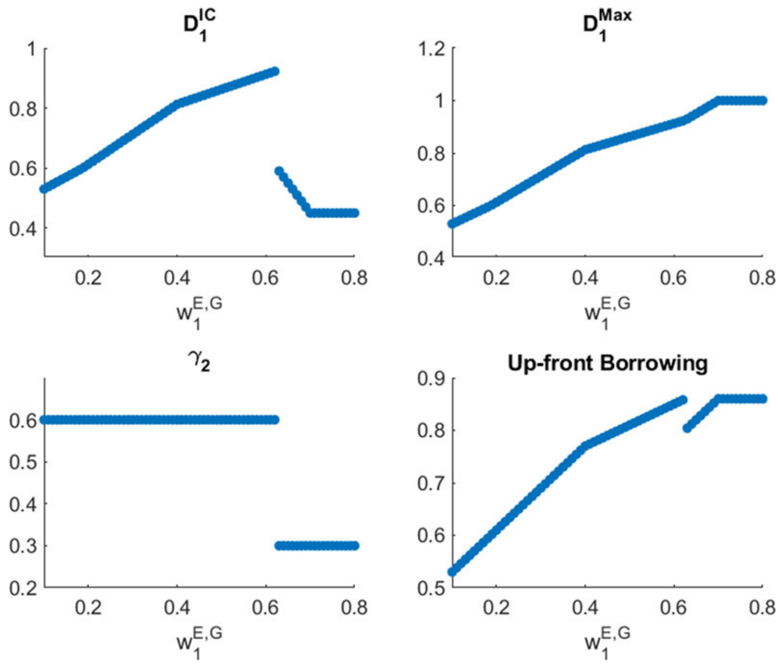

Figure 4. The effect of anticipated liquidity. (Color figure can be viewed at wileyonlinelibrary.com)

G, always increases incentive-compatible leverage and the amount raised up front but does not affect pledgeability.

However, once industry liquidity in state G exceeds the level at which, with high pledgeability, bidders can bid full value for the asset (i.e., Assumption 2(a) no longer holds), high pledgeability increases bids by less than the amount $(\bar{\gamma} - \underline{\gamma})C_2$ and increased industry liquidity reduces the benefit of high pledgeability in state G without changing the cost to the incumbent of high pledgeability in state B. As a result, D_1^{IC} still increases with $\omega_1^{E,G}$ but the slope is flatter. As $\omega_1^{E,G}$ continues to increase, the benefit of high pledgeability in state G falls further. When the benefit gets sufficiently low ($\omega_1^{E,G}$ increases from 0.62 to 0.63 under the given parameters), D_1^{IC} has to drop discontinuously to reduce the cost that arises under state B, given the low benefit in the G state, so as to encourage high pledgeability. Consequently, the incentive-compatible face value of the debt must drop discontinuously, so D_1^{IC} decreases with $\omega_1^{E,G}$. Interestingly, the debt level that raises the most up front is no longer incentive-compatible ($D_1^{\text{Max}} > D_1^{IC}$). By choosing a high debt level and pledging out more in the good state, the borrower is able to borrow more even though pledgeability is disincentivized. Also, because of the higher level of moral hazard, the increase in anticipated liquidity from 0.62 to 0.63 actually reduces the up-front amount raised as the bottom right panel shows. So at a high level of liquidity, the face value of debt rises with industry liquidity, but the amount raised falls, raising the effective spread. Finally, as $\omega_1^{E,G}$ increases above 0.7, there is no potential underpricing of the firm in state G, and no incentive to raise pledgeability can come from that state.

Higher industry liquidity in booms can make highly levered nonincentive-compatible capital structures dominate less leveraged incentive-compatible capital structures, which can reduce the amount that a borrower can raise from financiers. All of this assumes that conditions are good enough that the liquidity of incumbents exceeds that of experts, in which case only variation in industry liquidity is relevant. In the next subsection, we show what happens if, in a period of distress, incumbents have less liquidity than experts.

C. Case 3: The Industry After a Period of Distress

Consider now the final case in which states G and B follow a period of distress, and hence there is less liquidity all around. If the incumbent has less liquidity than experts, as is likely after sustained hard times, the moral hazard problem may be much alleviated.

We make the following parametric assumptions for this case.

ASSUMPTION 3:

(a) $\omega_1^{E,G} + \underline{\gamma} C_2 < C_2$ *and* $\omega_1^{I,G} \geq \omega_1^{E,G}$*;*
(b) $\omega_1^{E,B} + \underline{\gamma} C_2 < C_2$ *and* $\omega_1^{I,B} < \omega_1^{E,B}$*.*

Assumptions 3(a) and 3(b) imply that industry liquidity is low enough in both states that bidders underprice the firm if pledgeability is set low. Furthermore, in state G, the incumbent (if capable) always retains control by outbidding experts, whereas in state B, the incumbent is outbid. The idea is that when good states follow bad ones, industry liquidity is moderate and the incumbent, with one period of strong production, has more liquidity than experts, whereas when a bad state follows a bad state, the incumbent is in more distress than are the experts.

Under Assumption 3(a), $D_1^{G,\mathrm{PayIC}} = \theta B_1^{E,G}(\underline{\gamma}) + (1-\theta) B_1^{E,G}(\bar{\gamma}) - \varepsilon$. Next, we describe $\Delta_1^B(\widehat{D}_1^B)$. Under Assumption 3(b), experts can always outbid the incumbent for any level of pledgeability.[7] Therefore, if the promised remaining payment $\widehat{D}_1^B$ exceeds the incumbent's bid $B_1^{I,B}(\gamma_2)$, the incumbent can never retain control of the firm and therefore becomes a seller. She sets pledgeability high as long as the proceeds from selling recoup the cost of setting pledgeability.

[7] Strictly speaking, there is one more case because we break ties in favor of the incumbent. If $C_2 = B_1^{E,B}(\bar{\gamma}) = B_1^{I,B}(\bar{\gamma})$ and $B_1^{E,B}(\underline{\gamma}) > B_1^{I,B}(\underline{\gamma})$, the incumbent retains control if she chooses high pledgeability and retains ability, because she is able to pay the full value of the asset C_2 and experts will not outbid her. By contrast, if she chooses low pledgeability and debt is above $B_1^{I,B}(\underline{\gamma})$, she loses control because the high promised remaining payment is enforceable and higher than what she can pay. The maximum level of debt is as in this case.

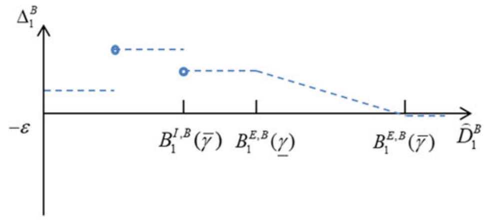

Figure 5. $\Delta_1^B(\widehat{D}_1^B)$ **as a function of** $\widehat{D}_1^B$. (Color figure can be viewed at wileyonlinelibrary.com)

In other words, her payoff is $V_1^B(\widehat{D}_1^B, \gamma_2) = \max\{B_1^{E,B}(\gamma_2) - \widehat{D}_1^B, 0\} - \varepsilon \cdot 1_{\{\gamma_2 > \underline{\gamma}\}}$ if $\widehat{D}_1^B > B_1^{I,B}(\gamma_2)$. By setting remaining payments at or below $\widehat{D}_1^{B,\mathrm{Max}} = B_1^{E,B}(\bar{\gamma}) - \varepsilon$, the incumbent will have incentives to increase next period's pledgeability to $\bar{\gamma}$. Lemma 3 formalizes these results.

LEMMA 3: *Under Assumption 2(b),* $\Delta_1^B(\widehat{D}_1^B) = 0$ *if* $\widehat{D}_1^B = B_1^{E,B}(\bar{\gamma}) - \varepsilon$. *Moreover,* $\Delta_1^B(\widehat{D}_1^B) \geq -\varepsilon$.

PROOF: See the Appendix, where we also lay out the full expression for $\Delta_1^B(\widehat{D}_1^B)$.

In Figure 5, we plot the function $\Delta_1^B(\widehat{D}_1^B)$ against $\widehat{D}_1^B$, where we assume that $B_1^{E,B}(\underline{\gamma}) \geq B_1^{I,B}(\bar{\gamma})$ (the case $B_1^{E,B}(\underline{\gamma}) < B_1^{I,B}(\bar{\gamma})$ is very similar). Importantly, $\Delta_1^B(\widehat{D}_1^B) > 0$ for all levels of debt below $B_1^{E,B}(\bar{\gamma}) - \varepsilon$. Even if debt exceeds $B_1^{E,B}(\bar{\gamma}) - \varepsilon$, $\Delta_1^B(\widehat{D}_1^B) \geq -\varepsilon$, that is, the cost of increasing pledgeability is not significantly negative for any level of debt, unlike in Figure 3. At very low levels of debt, the incumbent will retain control if she retains ability, but the expected benefit of selling at a higher price when she loses ability outweighs the cost of higher repayment when she retains it, so she benefits from setting pledgeability high. At higher levels of debt, because there is potential underpricing and the incumbent has no hope of retaining control if she enters an auction, the incumbent sees only the upside of increasing pledgeability. Even for very high promised values of $\widehat{D}_1^B$—above the most the asset could be sold for—the only disadvantage of choosing high pledgeability is its cost, ε. The more general point is that lower incumbent liquidity relative to the industry reduces moral hazard over pledgeability because the incumbent is more likely to be a seller of the asset.

(9) Pledgeability Choices

Recall that the incumbent will choose high pledgeability if and only if $q\Delta_1^G(D_1 - \gamma_1 C_1) + (1-q)\Delta_1^B(D_1) \geq 0$. In state B, as we see above, $\Delta_1^B(\widehat{D}_1^B) \geq -\varepsilon$

for any $\widehat{D}_1^B$. Therefore, the incentive constraint depends only on the incumbent's incentive stemming from state G (provided she recovers cost $\varepsilon \to 0$). The incumbent has ex ante incentives to increase pledgeability whenever there are incentives in state G (i.e., whenever $\Delta_1^G(\widehat{D}_1) \geq 0$).[8] We thus have the following result.

PROPOSITION 5: *Given Assumption 3 and $\varepsilon \to 0$, there exists a unique threshold D_1^{IC} such that the incumbent manager sets high pledgeability if and only if $D_1 \leq D_1^{IC}$, where $D_1^{IC} \to \gamma_1 C_1 + D_1^{G,\mathrm{PayIC}}$.*

Finally, in contrast again to the case in Section III.A, D_1^{IC} is indeed the face value that enables the incumbent to raise the most at date 0. In this case, she repays $\gamma_1 C_1 + D_1^{G,\mathrm{PayIC}}$ in state G and $B_1^{E,B}(\bar{\gamma})$ in state B. Any D_1 above D_1^{IC} will induce low pledgeability, and the incumbent can commit to pay strictly less: she repays $\gamma_1 C_1 + B_1^{E,G}(\underline{\gamma})$ in state G and $B_1^{E,B}(\underline{\gamma})$ in state B. Any D_1 below D_1^{IC} will lead to a lower payment in state G, and can never increase the payment in state B. We therefore have the following result.

PROPOSITION 6: *Given Assumption 3 and with $\varepsilon \to 0$, the face value that allows the incumbent to raise the maximum amount at date 0 is $D_1^{\mathrm{Max}} = D_1^{IC} = \gamma_1 C_1 + D_1^{G,\mathrm{PayIC}}$. In this case, she raises $q(\gamma_1 C_1 + D_1^{G,\mathrm{PayIC}}) + (1-q)B_1^{E,B}(\bar{\gamma})$ at date 0. For any promised payment $D_1 \leq D_1^{\mathrm{Max}}$, $\gamma_2 = \bar{\gamma}$.*

Moral hazard over pledgeability stems from the incumbent wanting to hold on to assets when they sell for less than full value (or equivalently, wanting to reduce the threat that experts will outbid her using the firm's enhanced borrowing capacity). In state B of Case 3, the incumbent has lower personal liquidity, so she knows she cannot outbid experts and therefore is resigned to a sale. This reduces moral hazard over pledgeability and hence increases the debt that she can raise up front, relative to what would be possible if she had more personal wealth and could have stayed in control (state B of Case 2).

IV. Robustness

We discuss the robustness of the basic model in this section.

A. Dynamic Effects

In Section III.A.4, we show that a low-ability manager can win the initial auction and acquire control of the firm in illiquid states. In the Internet Appendix, we add one more period and study the dynamic implications of selling the asset to low types. We show that the prospect of selling to low types actually increases

[8] We implicitly assume that $\gamma_1 C_1 + D_1^{G,\mathrm{PayIC}} > B_1^{E,B}(\bar{\gamma})$. Since $\gamma_1 C_1 + D_1^{G,\mathrm{PayIC}} = \gamma_1 C_1 + \theta \min\{\omega_1^{E,G} + \underline{\gamma} C_2, C_2\} + (1-\theta)\min\{\omega_1^{E,G} + \bar{\gamma} C_2, C_2\} - \varepsilon$ and $B_1^{E,B}(\bar{\gamma}) = \min\{\omega_1^{E,B} + \bar{\gamma} C_2, C_2\}$, this condition is automatically satisfied if $\gamma_1 = \bar{\gamma}$ and $C_1 = C_2$.

the level of debt under which high pledgeability is incentive-compatible. The reason is as follows. The presence of low types in illiquid states increases the sale price of the asset when low pledgeability has been chosen. As a result, the incremental cost of choosing high pledgeability over low pledgeability in the illiquid state is reduced, so that higher debt can be sustained without violating the pledgeability constraint. The presence of low types can therefore improve the choice of pledgeability and increase incentive-compatible leverage. As a result, when the illiquid state is realized, pledgeability may still be high and misallocation to low types is avoided. Somewhat paradoxically, the potential presence of outsider bidders can improve pledgeability incentives and reduce their actual use in managing firms. Nevertheless, similar to Section III.A.4, in our model outsiders will sometimes take over the firm in states of low liquidity and they will typically be drafted to enhance pledgeability.

B. Different Assumptions on Ability Loss

We have seen that the moral hazard over pledgeability is mitigated by low firm stability—because if the incumbent loses ability with high probability, in which case she will have to sell, she has incentives to choose high pledgeability. What if she could lose some ability but not all? As we show in the Internet Appendix, if she can retain control even after choosing low pledgeability and losing some ability, this increases the moral hazard over pledgeability. Specifically, given sufficient ability to stay in control, the more ability she retains, the lower is the incentive-compatible level of debt. The intuition is straightforward. When she loses some ability but not all, there is more of a chance she can stay in control and earn rents from underpriced assets, rather than sell. Given that she is more likely to be a buyer than if she lost all ability, she has lower incentives to increase pledgeability.

This also means that there is an additional source of allocative inefficiency in this case, when the incumbent is entrenched and refuses to sell the firm even when she loses ability vis-à-vis experts. Low pledgeability reduces what she has to pay to stay on, thus increasing her rents from doing so, and can outweigh any loss in production from her relative disability.

C. Setting Current Pledgeability

We have assumed that the incumbent only affects future pledgeability. What if she could also affect current pledgeability? Because current-period debt is already in place, the incumbent manager has no incentives to increase current-period pledgeability. If she could reduce it, she always would do so, because current-period debt is already contracted and her action will have no effect on the interest rate charged. So we could allow the incumbent manager to reduce currently set pledgeability somewhat, so as to reduce committed payment and increase her wealth, but our analysis would again focus on her choice of future pledgeability, where the range she chooses from, $[\underline{\gamma}, \bar{\gamma}]$, is computed as the pledgeability she can set for the future, net of the maximum amount the future incumbent can push inherited pledgeability down by.

D. Financing Need with Probability $(1-\theta)$

An alternative to the incumbent's loss of ability as a reason for her to be a seller of the firm is the need to raise funds. Suppose the incumbent does not lose ability, but rather with probability $1-\theta$ the firm faces a liquidity shock that requires that the firm raise L units of capital by the beginning of the next period to produce cash flows during the next period (a shock similar to that in Holmstrom and Tirole (1998)). This requirement of L does not change the cash flows in the future– it simply reduces their net present value by L. We assume that if cash flows were fully pledgeable, it would make sense to raise and invest L, but L cannot be raised if pledgeability is low. An alternative narrative for this situation would define the shock as an investment opportunity that needs funding that is not financeable if the firm's assets have low pledgeability.

It turns out that the need to raise financing has similar effects as the loss of ability—it converts the incumbent into a seller of (part of) the firm, and gives her incentives to increase pledgeability. Although the details of the analysis obviously differ from what we present above (see the Internet Appendix), the main conclusions from such an analysis are qualitatively similar.

An interesting extension would be to consider state-contingent investment opportunities. If there are fewer funding requirements in bad states, while the industry is very liquid in good states when financing is needed, the incentives to increase pledgeability would be even lower than what we analyze in our model.

E. Long-Term Debt Contracts

We have assumed short-term debt contracts, where the borrower must pay each period to retain control, as opposed to long-term contracts, where large date-2 payments are specified and only small (or zero) date-1 payments are promised. An initial bidder at date 0 who borrows long-term debt with no required payment on date 1 has similar incentives in choosing pledgeability as low types. If she acquires control of the firm, no payments will be due at date 1, so she always prefers high pledgeability, conditional on potential underpricing in at least one of the two states. Therefore, she can credibly commit to repay $\bar{\gamma}C_2$ at date 2 and hence can borrow $\bar{\gamma}C_2$ up front. Interestingly, this is clearly dominated by the amount that low types can borrow, so long as the level of date-1 industry liquidity is positive in at least one of the two states. Intuitively, short-term debt enables low types to sell the asset at a price that incorporates both the high pledged cash flows in period 2 and experts' liquidity at date 1. So long-term debt would not improve on outcomes.

In general, if the incumbent could dilute the value of old debt (issued at date 0), long-term debt with a coupon promised on date 1 can never raise more than short-term debt. Such dilution can happen due to new debt issued at date 1, in which case no long-term debt will be honored. Even if the debt issued on date 1 is restrained to be junior to existing long-term debt, the incumbent will have incentives to strategically default and accelerate all claims to date 1, followed by an auction with a new capital structure (as would happen in a bankruptcy). Intuitively, accelerating claims transfers payments across periods, and the total amount that the incumbent can repay is capped by experts' bids. Therefore, payment acceleration will always lead to (weakly) lower payment overall. With all claims accelerated, long-term debt essentially becomes short term. Therefore, if the goal is to raise the maximum up-front proceeds, it is without loss of generality to assume that initial bidders only borrow short-term debt. The Appendix contains the formal analysis.

F. Public Equity Contracts

With debt contracts, the firm is auctioned off only if the incumbent misses a payment. We have assumed that no equity takeover threats can displace the incumbent. Suppose instead that there is a takeover threat with given probability each period and there is potential underpricing so that takeover bids are increased by an increase in pledgeability. If the probability of a takeover bid is sufficiently high and outside shareholders own a sufficient fraction of equity, then the incumbent's incentives in setting pledgeability are similar to those with short-term debt: If the incumbent is likely to be a buyer (i.e., she has the potential to outbid others in a takeover), she will have little incentive to increase pledgeability, whereas if she is likely to be a seller (i.e., lose her skill or need to raise future funding), she will have incentives to increase pledgeability. This would suggest that young firms with large future funding needs or a possible need to sell out will maintain high pledgeability even if they only issue outside equity. As with our analysis with debt contracts, higher anticipated liquidity in some states will crowd out incentives to increase pledgeability. The disincentive to raise pledgeability will be more if the incumbent retains a smaller stake in the firm, which is analogous to having too much debt.

G. State-Contingent Contracts

What aspects of our analysis hold when we consider state-contingent contracts instead of debt contracts? It turns out that much of our analysis is preserved, including the sale of the firm to outsiders because moral hazard over pledgeability limits how much experts can raise for their bids. The focus on state-contingent contracts also allows us to consider the comparative statics in more detail (see the Internet Appendix). We can show that the maximum credible payment in state s_1, $\widehat{D}_1^{s,\text{Max}}$, decreases (weakly) with incumbent wealth ω_1^{I,s_1}, because higher ω_1^{I,s_1} means that the incumbent is more likely to be a buyer, which increases moral hazard over pledgeability. An increase in stability, θ, reduces the maximum feasible payment for similar reasons. Finally, an increase in *industry liquidity* ω_1^{E,s_1} always increases $\widehat{D}_1^{s,\text{Max}}$. There are two channels at work here. An increase in industry liquidity pushes up the amount that experts can pay, $B_1^{E,s}(\gamma_2)$, for any level of pledgeability, and it expands the parameter ranges in which there is no potential underpricing or the incumbent cannot retain control. Consequently, again, the maximum pledgeable payment increases.

What does not carry over to state-contingent contracts is the spillover between future states that is induced by debt contracts. High liquidity in one future state will not necessarily induce low pledgeability in other states. This is why we emphasize debt, though the concept of pledgeability applies more generally.

V. Empirical Implications and Related Literature

A. Empirical Implications

What are the empirical implications of our work? Our primary novel implication is that in addition to the positive effect of liquidity on leverage predicted by other papers, it has an adverse effect on pledgeability. In general, leverage levels are set to encourage an increase of pledgeability, but in times of great liquidity, pledgeability might be sacrificed for greater borrowing. At such times, we should observe a negative correlation between measures of liquidity and proxies for pledgeability.

A second implication is that in a downturn following a period of great liquidity, we should find required debt payments to be "excessive" given the availability of liquidity. Not only is debt set to be repayable in the highly liquid state when added pledgeability is not needed, but given neglected pledgeability, even levels of expert borrowing against the firm's assets that are ordinarily consistent with the reduced liquidity are unsupportable. Therefore, corporate asset sale prices will have a larger-than-usual discount, and the process of deleveraging will tend to overshoot on the downside, giving scope for releveraging once pledgeability is restored. Debt will thus tend to have more amplified cycles than liquidity.

Turning to the cross-sectional implications, in growing industries firms are likely to be cash-constrained. These are firms that would want to enhance pledgeability. At the same time, these are likely to be young firms without much of a governance record. The empirical implication is that, ceteris paribus, firms with greater growth opportunities in need of funding are likely to have higher pledgeability.

Finally, outsiders, including financiers and government entities (like the Reconstruction Finance Corporation during the Depression), play a useful role after episodes of high liquidity and associated leverage, not just in preventing fire-sale prices for assets, but also in restoring pledgeability. Firms might need to be managed at such times, both to maximize cash flows and to improve governance. There may be a trade-off between the two in that those best positioned to maximize firm cash flows may not have the incentives to improve governance. Commitments to sell eventually (as with bankruptcy administrators or leveraged buyout teams) may be important to improve incentives for management to improve governance.

B. Proxies for Pledgeability and Evidence

When a firm anticipates that it will need to raise financing, it will want to have in place high-quality auditors who report accounting earnings accurately, which is a form of pledgeability. Our model then predicts that in booms that are likely to continue, the firm will not have incentives for highly reliable accounting, whereas in normal times with limited industry liquidity, it will.

We are not aware of studies that explicitly test for the cyclical demand for ex ante auditor quality, but there is evidence of cyclical audit quality, with quality lower during industry booms. Lisowsky, Minnis, and Sutherland (2017) examine the construction sector over the financing cycle. Specifically, they study the housing boom-bust cycle over the 2002 to 2011 period and find that banks required, on average, fewer high-quality, audited financial statements from construction firms (relative to other firms) before lending to them during the housing boom than prior to 2008. This trend was reversed, however, during the subsequent downturn between 2008 and 2011. Interestingly, during the downturn, banks that collected fewer high-quality financial reports also experienced larger loan losses. This pattern is consistent with our theory of the financing cycle whereby high industry liquidity induces low pledgeability, which leads to a larger loss-given-default if a downturn occurs.

Consider another suggestive bit of evidence. Our model predicts that low-reliability accounting will be chosen (and subsequently unearthed) when liquidity is anticipated to be plentiful at the time of choice. Compustat reports the auditor's opinion of the effectiveness of the company's internal controls over financial reporting while auditing a company's financial statements, an opinion that is mandated by Section 404 of the 2002 Sarbanes-Oxley Act. A material weakness is a deficiency, or a combination of deficiencies, in internal controls over financial reporting, such that there is a reasonable possibility that a material misstatement of the company's annual or interim financial statements will not be prevented or detected on a timely basis. When an auditor indicates a material weakness, it signals a previously undetected choice to degrade accounting reliability, and thus can serve as a measure of a previous choice of low pledgeability. Figure 6 shows that the percentage of Compustat firms with a material weakness with respect to internal controls fell sharply during the crisis, and started to increase again as central banks around the world maintained extremely liquid conditions in financial markets.

Loan contracts with few covenants could also be a proxy for the choice of low pledgeability. Although such a loan contract does not prevent subsequent potential acquirers from issuing debt with strong covenants, it does allow the firm to violate conditions that would typically be written into strong covenants—such as capital ratios or minimum liquidity and quick asset ratios. As a result, a subsequent would-be acquirer may find that the firm simply cannot issue

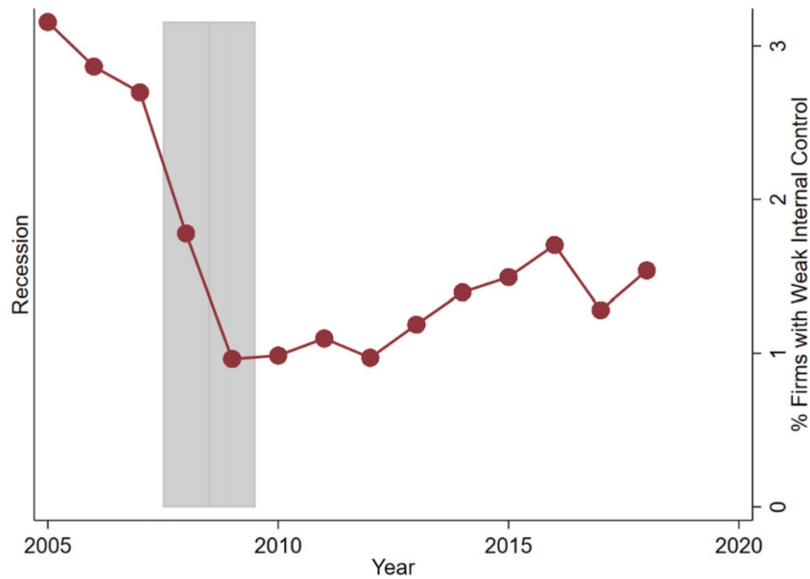

Figure 6. Weakness of internal control. This figure plots the series of percentage of firms that were reported as having weak internal controls. The data are obtained as the variable AUOPIC from the Compustat Annual database. This dummy variable is set to one for firms reporting an internal control deficiency, which is a material weakness in the client's internal control systems, in the restatement year and/or the two subsequent years, otherwise it is set to zero. (Color figure can be viewed at wileyonlinelibrary.com)

debt with strong and detailed covenants—it would be in violation immediately. More generally, covenant-lite loans may reflect a general disdain for cash flow pledgeability, given that abundant liquidity makes it easy to raise loans.

If so, in bad to normal times we should see many covenants and relatively low levels of leverage when fresh capital structures are chosen (such as when the firm comes out of bankruptcy). In contrast, during booms we should see higher leverage and greater use of covenant-lite loans (i.e., loans without maintenance covenants such as maximum payout ratios or minimum liquid asset ratios). Boom periods could also see an increase in the fraction of unmonitored market finance (bonds or covenant lite loans) relative to intermediated finance (covenant-intensive bank debt). Indeed, in Figure 7 we see that the pattern in the use of covenant-lite loans mirrors the weakness in internal controls depicted in Figure 6—there is an increase in the use of covenant-lite loans in the 2006 to 2007 period of extremely high liquidity, followed by a fall, then an increase as central banks instituted extremely accommodative conditions. Becker and Ivashina (2016) show that before 2004, covenant-lite leveraged loans were extremely rare, except for higher levels between 1% and 5% during the 1997 to 1999 period, the liquid period of the dot-com boom.

Finally, the fluctuation in debt capacity over the cycle may be larger if the range over which pledgeability can fluctuate is larger. To the extent that

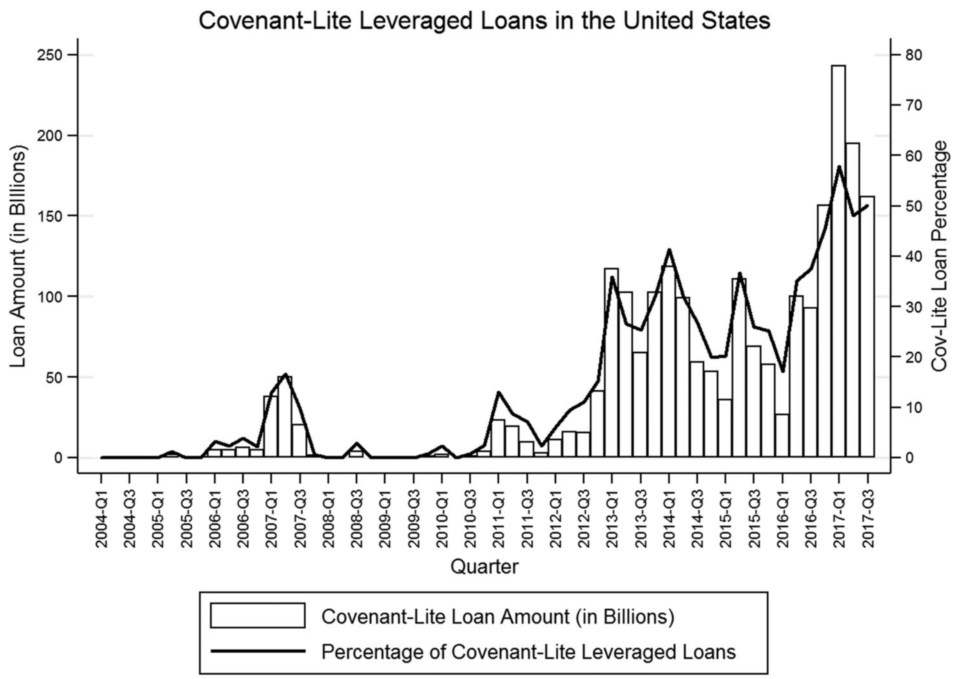

Figure 7. Covenant-lite loans and as fraction of leveraged loans.

financial infrastructure such as accounting standards or collateral registries as well as contract enforcement are at levels high enough to ensure high minimum pledgeability over the cycle, they prevent large fluctuations in asset pledgeability and hence credit. Countries with more developed financial infrastructure should have more muted financial cycles stemming from variation in pledgeability.

C. Related Literature

Our paper builds on Shleifer and Vishny (1992), where the high net worth of industry participants allows assets to sell for their fundamental value because the best user of an asset can outbid less efficient users. This leads to efficient reallocation in good times (also see Brunnermeier and Sannikov (2014)). Shleifer and Vishny (1992) argue that debt set to curb overinvestment in a boom can prove problematic in a downturn, as reallocation to inefficient users takes place because experts are less liquid than outsiders. The key difference in our paper is the source of managerial moral hazard—not overinvestment but pledgeability. The interesting results in our model emerge because as liquidity increases leverage, it also depresses pledgeability. Higher anticipated liquidity would not be problematic in Shleifer and Vishny (1992) if debt were renegotiable ex post, unlike in our model where its effects can be transmitted through lower pledgeability into worse allocations ex post and lower funding ex ante.

Eisfeldt and Rampini (2008) develop a theory in which asset reallocation is more efficient in good times. Good times increase required cash compensation to managers because reservation managerial wages become elevated. As a result, high-ability managers will accept lower wages in return for the benefit of managing more assets. They use the differential compensation to bribe low-ability managers to give up their assets. In bad times, managerial compensation is lower and even if high-ability managers accepted zero cash compensation, it would not be sufficient to bribe low-ability managers to give up their assets. This leads to a more efficient reallocation of capital (high compensation and therefore high manager liquidity) in good times and less in bad.

In both Shleifer and Vishny (1992) and Eisfeldt and Rampini (2008), adjusting for current conditions (such as industry net worth or compensation), past actions do not affect financial capacity or the efficiency of asset reallocation today. In contrast, in our model, history matters over and above the effects of leverage because of pledgeability, which allows us to explain prolonged downturns following booms and to sketch the possibility of financing cycles.

Our notion of pledgeability relates to Dow, Gorton, and Krishnamurthy (2005), who present a model in which debt essentially serves the function of high pledgeability by forcing payouts. In contrast, we distinguish between debt and pledgeability. Thus, while Dow, Gorton, and Krishnamurthy (2005) would predict high pledgeability in booms (which accords with our prediction on debt), our model predicts low pledgeability (in the sense of poorer governance).[9] Holmstrom and Tirole's (1997, 1998) notion of pledgeability differs from ours in that they define it to be the amount that can be paid to outsiders taking into account moral hazard stemming from outside claims (similar to Diamond (1991), Section IX). Thus, in their model pledgeability is an outcome of capital structure choices and the environment, whereas in our paper it is a direct choice variable that constrains tunneling.

Acharya and Viswanathan (2011) also predict that an anticipated boom that does not materialize can lead to a more severe downturn because it encourages more entry heterogeneity.[10] An increase in liquidity will always increase ex ante financing in their paper, but not ours. Rampini and Viswanathan (2010) present a dynamic model that gives rise to an endogenous state-contingent collateral constraint and predicts a less efficient allocation of capital in bad

[9] Phillipon (2006) presents a model in which firms vary in the quality of their corporate governance and overinvest in the absence of good governance. In a boom that raises the productivity of all firms, those firms with poor governance face less outside restrictions on investment and are able to raise more funding. This leads to greater fluctuations in productivity and investment than in an economy with good corporate governance in all firms. Our paper focuses more on changes in governance over the cycle but is similar to Phillipon (2006) in that effective governance is lower in a boom.

[10] This is also related to Dell'Arriccia and Marquez (2006), who show that high credit demand reduces the degree of adverse selection in the market and thus causes banks to suspend screening. See Hu (2018) for a dynamic extension with borrowers' endogenous entry.

times; more productive firms will use their net worth to invest and will hedge less, giving them less future net worth in future recessions. Our paper assumes away contingent contracting (when we study debt contracts) but endogenizes the pledgeability choice (θ in their paper, for example). By doing so, we are able to discuss the implications of high industry liquidity (as opposed to the firm's own net worth) on pledgeability, leverage, and alternative financing methods.

Our paper also bears some resemblance to papers where a small probability of a regime change is irrationally (Gennaioli, Shleifer, and Vishny (2015)) or rationally (Dang, Gorton, and Holmstrom (2012)) neglected, though our results on the effect of anticipated liquidity on leverage and pledgeability hold even if the probability of the seemingly neglected state is not small. Our point is that the low pledgeability set in good times cannot be reversed immediately in bad times, unlike expectations of outcomes or information acquisition or even leverage, because pledgeability takes time to reset. Therefore, not only is there a collapse in access to finance, but a restoration of access takes time. Our result resembles papers by Geanakoplos (for instance, Geanakoplos (2010)) that show how belief heterogeneity generates leverage cycles—which are analogous to our financing cycles. Our model instead assumes that all agents have the same beliefs about the future and that high leverage pushes them to rationally neglect to prepare (by neglecting pledgeability) for less liquid states.

VI. Conclusion

In good times, bidders have plentiful liquidity and do not need cash flow pledgeability to make high bids. Firms can issue enforceable debt contracts without maintaining cash flow pledgeability. This alternative source of commitment seems unnecessary when times largely promise to be good, and incentives to maintain high pledgeability are further reduced by the high leverage that is induced by liquidity.

When bad times hit, financing capacity plunges, and outsiders who have better ability to take on leverage may outbid experts. Cash flow pledgeability now becomes key to debt capacity, and industry outsiders have incentives to increase it even in the face of high debt—it is precisely their ineffectiveness in managing the asset that makes them immune from moral hazard over pledgeability. As cash flow pledgeability increases and industry cash flows recover somewhat, experts can once again bid large amounts and return to controlling firms. As liquidity among experts increases further, incentives to maintain cash flow pledgeability wane once again, and the cycle resumes.

In this paper, we focus on the choice of pledgeability, assuming that both the incumbent and experts have access to the same sources of pledgeability. However, incumbent pledgeability could be different from the pledgeability that experts can employ—the incumbent may be able to borrow more from relationship banks than can an industry expert who does not know the bankers. The gap between incumbent pledgeability and industry pledgeability, especially over the cycle, deserves study.

The existence of institutions that support pledgeability may also change over the financing cycle. When there is a prolonged aggregate boom (with a good probability of continuing), there will be little demand for increased pledgeability. The institutions and professions that reinforce pledgeability will atrophy, and those with related skills (such as forensic accountants) will depart these professions. This would make it more difficult to increase pledgeability when other firms do not value such an increase. We plan to explore more of these implications in future work.

In this paper, we also assume that the industry's net worth, which is the source of liquidity, is independent of the availability of finance. In practice, the latter will determine investment, which will drive cash flows and net worth. A more comprehensive model that analyzes interactions between the two is left to future work.

Finally, in ongoing work, we recognize that pledgeability may be jointly determined by firm managers and a lender, say, by the latter monitoring more closely and insisting on a variety of conditional control rights through covenants. Because such lenders– typically financial intermediaries—will need to raise money themselves, and will have to bind themselves to do the right thing by preserving sufficient "skin in the game" through capital, we can get implications for the effects of liquidity on intermediary capital ratios (see Diamond, Hu, and Rajan (2019) for an initial effort). The model, therefore, offers rich prospects for future work.

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Appendix

A. *Proof of Proposition 4*

We can define $D_1^{G,\text{PayIC}} = \theta B_1^{E,G}(\underline{\gamma}) + (1-\theta)B_1^{E,G}(\bar{\gamma}) - \varepsilon$ and $D_1^{B,\text{PayIC}} = \theta B_1^{E,B}(\underline{\gamma}) + (1-\theta)B_1^{E,B}(\bar{\gamma}) - \varepsilon$ such that the benefits from choosing high versus low pledgeability satisfy $\Delta_1^G(D_1^{G,\text{PayIC}}) = \Delta_1^B(D_1^{B,\text{PayIC}}) = 0$. Because $\Delta_1^s(\hat{D}_1^s)$ decreases (weakly) monotonically in $\hat{D}_1^s$, there exists a $D_1 \in [D_1^{B,\text{PayIC}}, \gamma_1 C_1 + D_1^{G,\text{PayIC}}]$ that satisfies $q\Delta_1^G(D_1 - \gamma_1 C_1) + (1-q)\Delta_1^B(D_1) = 0$. Let D_1^{IC} be that D_1, or the maximum such D_1 if not unique.[11] Then, D_1^{IC} will be such that the incumbent sees an expected positive benefit from raising pledgeability in the G state (because $D_1^{IC} < \gamma_1 C_1 + D_1^{G,\text{PayIC}}$) and an equal expected negative benefit (or cost) from doing so in the B state (because $D_1^{IC} > D_1^{B,\text{PayIC}}$). The net benefit of setting high pledgeability in either state is summarized by Lemma 2. Note that the (expected) benefit in state G is capped

[11] Note that D_1^{IC} is not unique only if $q(1-\theta)[B_1^{E,G}(\bar{\gamma}) - B_1^{E,G}(\underline{\gamma})] = (1-q)\theta[B_1^{E,B}(\bar{\gamma}) - B_1^{E,B}(\underline{\gamma})]$. If so, we can pick the highest D_1^{IC}.

at $q(1-\theta)[B_1^{E,G}(\bar{\gamma}) - B_1^{E,G}(\underline{\gamma})]$, and the (expected) cost in state B is at most $-(1-q)\theta[B_1^{E,B}(\bar{\gamma}) - B_1^{E,B}(\underline{\gamma})]$.

By setting the face value of debt to D_1^{IC}, the incumbent is able to raise $qD_1^{IC} + (1-q)\min\{D_1^{IC}, B_1^{E,B}(\bar{\gamma})\}$ at date 0. If $D_1^{IC} \geq \gamma_1 C_1 + B_1^{E,G}(\underline{\gamma})$, the incentive-compatible level of debt is what enables the incumbent to raise the most up front. Otherwise, if $\gamma_1 C_1 + B_1^{E,G}(\underline{\gamma}) > D_1^{IC}$, we have to check if the incumbent can borrow more by setting $D_1 = \gamma_1 C_1 + B_1^{E,G}(\underline{\gamma})$ and raising $q(\gamma_1 C_1 + B_1^{E,G}(\underline{\gamma})) + (1-q)B_1^{E,B}(\underline{\gamma})$ up front. Let D_1^{Max} be the face value of debt that raises the maximum amount at date 0.

Before we derive conditions for high pledgeability choices, let us explain the expected gains and losses in both states. Note that the face value, if set at $\gamma_1 C_1 + B_1^{E,G}(\underline{\gamma})$, is strictly below $\gamma_1 C_1 + D_1^{G,\mathrm{PayIC}}$. Thus, in state G, the incumbent would always prefer high pledgeability. The size of the gain from choosing high pledgeability is $\Delta_1^G = (1-\theta)[B_1^{E,G}(\bar{\gamma}) - B_1^{E,G}(\underline{\gamma})] - \varepsilon$. Intuitively, if the incumbent keeps her ability, she needs to repay $D_1 = \gamma_1 C_1 + B_1^{E,G}(\underline{\gamma})$ no matter what pledgeability choice she makes. If she loses her ability, which occurs with probability $1-\theta$, the incumbent can sell the asset for additional value of $[B_1^{E,G}(\bar{\gamma}) - B_1^{E,G}(\underline{\gamma})]$ with high pledgeability. Therefore, the overall benefit is $(1-\theta)[B_1^{E,G}(\bar{\gamma}) - B_1^{E,G}(\underline{\gamma})] - \varepsilon$. Next, we examine the net loss if she chooses high pledgeability in state B when $D_1 = \gamma_1 C_1 + B_1^{E,G}(\underline{\gamma})$. Note that the net loss $-\Delta_1^B$ is at most $-\theta[B_1^{E,B}(\bar{\gamma}) - B_1^{E,B}(\underline{\gamma})] - \varepsilon$. This maximum net loss arises if and only if $D_1 = \gamma_1 C_1 + B_1^{E,G}(\underline{\gamma}) \geq B_1^{E,B}(\bar{\gamma})$. Intuitively, if the incumbent loses ability, she does not receive anything from the sale of assets after repaying debt, whatever level of pledgeability she chooses. If she keeps her ability, which occurs with probability θ, she needs to make additional payments if she chooses high pledgeability, which amounts to $B_1^{E,B}(\bar{\gamma}) - B_1^{E,B}(\underline{\gamma})$. Hence, the net loss from choosing high pledgeability.

For the remainder of the proof, we will derive both sufficient and necessary conditions for $D_1^{\mathrm{Max}} = D_1^{IC}$. Depending on parameters, we will analyze two different cases.

(1) If $\gamma_1 C_1 + B_1^{E,G}(\underline{\gamma}) \leq B_1^{E,B}(\bar{\gamma})$, so that the liquidity in state G is not far from liquidity in state B.
   (a) If $q(1-\theta) \geq (1-q)\theta$, or equivalently $q \geq \theta$, then at $D_1 = \gamma_1 C_1 + B_1^{E,G}(\underline{\gamma})$, the maximum expected gains in state G is attained, whereas the expected losses in state B is strictly below its maximum. Therefore, a sufficient condition for the gains to dominate the losses is $q\{(1-\theta)[B_1^{E,G}(\bar{\gamma}) - B_1^{E,G}(\underline{\gamma})] - \varepsilon\} \geq (1-q)\{-\theta[B_1^{E,B}(\bar{\gamma}) - B_1^{E,B}(\underline{\gamma})] - \varepsilon\}$. Given the assumption that the asset is underpriced even with high pledgeability (so that $[B_1^{E,G}(\bar{\gamma}) - B_1^{E,G}(\underline{\gamma})] = [B_1^{E,B}(\bar{\gamma}) - B_1^{E,B}(\underline{\gamma})] = (\bar{\gamma} - \underline{\gamma})C_2$), this is equivalent to $q(1-\theta) \geq (1-q)\theta$ when $\varepsilon \to 0$, or equivalently, $q \geq \theta$.

Therefore, under conditions in this case, $\gamma_1 C_1 + B_1^{E,G}(\underline{\gamma}) < D_1^{IC}$ and high pledgeability is always guaranteed.

(b) If $q < \theta$,

i. Comparing the incremental expected benefit from raising pledgeability when $D_1 = \gamma_1 C_1 + B_1^{E,G}(\underline{\gamma})$, it is easy to see that $q\Delta_1^G(B_1^{E,G}(\underline{\gamma})) > (1-q)\Delta_1^B(\gamma_1 C_1 + B_1^{E,G}(\underline{\gamma}))$ if $q(1-\theta)(\bar{\gamma} - \underline{\gamma})C_2 \geq (1-q)\{[\gamma_1 C_1 + B_1^{E,G}(\underline{\gamma})] - D_1^{B,\text{PayIC}}\}$. Then, $\gamma_1 C_1 + B_1^{E,G}(\underline{\gamma}) < D_1^{IC}$ and high pledgeability is always guaranteed. The condition $q(1-\theta)(\bar{\gamma} - \underline{\gamma})C_2 \geq (1-q)\{[\gamma_1 C_1 + B_1^{E,G}(\underline{\gamma})] - D_1^{B,\text{PayIC}}\}$ can be expressed in terms of primitives: $(\gamma_1 C_1 + \omega_1^{E,G}) - \omega_1^{E,B} \leq \frac{1-\theta}{1-q}(\bar{\gamma} - \underline{\gamma})C_2$.

ii. If $q(1-\theta)(\bar{\gamma} - \underline{\gamma})C_2 < (1-q)\{[\gamma_1 C_1 + B_1^{E,G}(\underline{\gamma})] - D_1^{B,\text{PayIC}}\}$, then following the previous bullet point, $q\Delta_1^G(B_1^{E,G}(\underline{\gamma})) < (1-q)\Delta_1^B(\gamma_1 C_1 + B_1^{E,G}(\underline{\gamma}))$ so that $D_1^{IC} < \gamma_1 C_1 + B_1^{E,G}(\underline{\gamma})$. In this case, we can derive the explicit expression $D_1^{IC} \to D_1^{B,\text{PayIC}} + \frac{q(1-\theta)}{1-q}(\bar{\gamma} - \underline{\gamma})C_2$ as $\varepsilon \to 0$. In this case, high pledgeability is chosen if and only if $D_1^{IC} > q[\gamma_1 C_1 + B_1^{E,G}(\underline{\gamma})] + (1-q)B_1^{E,B}(\underline{\gamma})$.

(2) If $\gamma_1 C_1 + B_1^{E,G}(\underline{\gamma}) > B_1^{E,B}(\bar{\gamma})$,

(a) If $q \geq \theta$, then $D_1^{IC} > \gamma_1 C_1 + B_1^{E,G}(\underline{\gamma}) \geq B_1^{E,B}(\bar{\gamma})$ and high pledgeability is always guaranteed. The proof follows case (1a), with the minor difference that at $D_1 = \gamma_1 C_1 + B_1^{E,G}(\underline{\gamma})$, both the maximum expected gains in state G and the maximum expected losses in state B are attained.

(b) If $q < \theta$, then $\gamma_1 C_1 + B_1^{E,G}(\underline{\gamma}) \geq B_1^{E,B}(\bar{\gamma}) > D_1^{IC}$. Similarly, we can derive the explicit expression $D_1^{IC} \to D_1^{B,\text{PayIC}} + \frac{q(1-\theta)}{1-q}(\bar{\gamma} - \underline{\gamma})C_2$ as $\varepsilon \to 0$. In this case, high pledgeability is chosen if and only if $D_1^{IC} > q[\gamma_1 C_1 + B_1^{E,G}(\underline{\gamma})] + (1-q)B_1^{E,B}(\underline{\gamma})$.

To summarize, by combining case (1a), (1bi), and (2a), a set of sufficient conditions for high pledgeability is (i) $q < \theta$ and $(\gamma_1 C_1 + \omega_1^{E,G}) - \omega_1^{E,B} \leq \frac{1-\theta}{1-q}(\bar{\gamma} - \underline{\gamma})C_2$ (case 1bi), or (ii) $q \geq \theta$ (case 1a and 2a).

B. Proof of Lemma 3

Under Assumption 2(b), $V_1^{I,B}(\widehat{D}_1^B, \bar{\gamma})$ and $V_1^{I,B}(\widehat{D}_1^B, \underline{\gamma})$ are given as follows:

$$V_1^{I,B}\left(\widehat{D}_1^B, \bar{\gamma}\right) = \begin{cases} -\varepsilon & \text{if } \widehat{D}_1^B > B_1^{E,B}(\bar{\gamma}) \\ B_1^{E,B}(\bar{\gamma}) - \widehat{D}_1^B - \varepsilon & \text{if } B_1^{I,B}(\bar{\gamma}) < \widehat{D}_1^B \leq B_1^{E,B}(\bar{\gamma}) \cdot \\ \theta C_2 + (1-\theta) B_1^{E,B}(\bar{\gamma}) - \widehat{D}_1^B - \varepsilon & \text{if } \widehat{D}_1^B \leq B_1^{I,B}(\bar{\gamma}) \end{cases}$$

$$V_1^{I,B}\left(\widehat{D}_1^B,\underline{\gamma}\right)=\begin{cases}-\varepsilon & \text{if } \widehat{D}_1^B > B_1^{E,B}\left(\underline{\gamma}\right)\\ B_1^{E,B}\left(\underline{\gamma}\right)-\widehat{D}_1^B-\varepsilon & \text{if } B_1^{I,B}\left(\underline{\gamma}\right)<\widehat{D}_1^B \le B_1^{E,B}\left(\underline{\gamma}\right)\\ \theta C_2+(1-\theta)\,B_1^{E,B}\left(\underline{\gamma}\right)-\widehat{D}_1^B-\varepsilon & \text{if } \widehat{D}_1^B \le B_1^{I,B}\left(\underline{\gamma}\right)\end{cases}.$$

The first and second case in both value functions are explained in the main body of the paper. In the third case, the promised payment levels are below the incumbent's bid $B_1^{I,B}(\gamma_2)$, so she is able to stay in control by repaying $\widehat{D}_1^B$. She chooses to do so if she keeps her ability, whereas she sells the firm if she loses ability. The continuation value in this case is $\theta C_2+(1-\theta)B_1^{E,B}(\gamma_2)-\widehat{D}_1^B-\varepsilon\cdot 1_{\{\gamma_2\ge\underline{\gamma}\}}$.

Taking the difference, the results on $\Delta^B(\widehat{D}_1^B)=V_1^{I,B}(\widehat{D}_1^B,\bar{\gamma})-V_1^{I,B}(\widehat{D}_1^B,\underline{\gamma})$ naturally follow.

If $B_1^{E,B}(\underline{\gamma})<B_1^{I,B}(\bar{\gamma})$, then

$$\Delta^B(\widehat{D}_1^B)=\begin{cases}-\varepsilon & \text{if } \widehat{D}_1^B > B_1^{E,B}(\bar{\gamma})\\ B_1^{E,B}(\bar{\gamma})-\widehat{D}_1^B-\varepsilon & \text{if } B_1^{I,B}(\bar{\gamma})<\widehat{D}_1^B \le B_1^{E,B}(\bar{\gamma})\\ \theta C_2+(1-\theta)B_1^{E,B}(\bar{\gamma})-\widehat{D}_1^B-\varepsilon & \text{if } B_1^{E,B}(\underline{\gamma})<\widehat{D}_1^B \le B_1^{I,B}(\bar{\gamma})\\ \theta C_2+(1-\theta)B_1^{E,B}(\bar{\gamma})-B_1^{E,B}(\underline{\gamma})-\varepsilon & \text{if } B_1^{I,B}(\underline{\gamma})<\widehat{D}_1^B \le B_1^{E,B}(\underline{\gamma})\\ (1-\theta)\left[B_1^{E,B}(\bar{\gamma})-B_1^{E,B}(\underline{\gamma})\right]-\varepsilon & \text{if } \widehat{D}_1^B \le B_1^{I,B}(\underline{\gamma}).\end{cases}$$

If $B_1^{E,B}(\underline{\gamma})\ge B_1^{I,B}(\bar{\gamma})$, then

$$\Delta^B(\widehat{D}_1^B)=\begin{cases}-\varepsilon & \text{if } \widehat{D}_1^B > B_1^{E,B}(\bar{\gamma})\\ B_1^{E,B}(\bar{\gamma})-\widehat{D}_1^B-\varepsilon & \text{if } B_1^{E,B}(\underline{\gamma}) < \widehat{D}_1^B \le B_1^{E,B}(\bar{\gamma})\\ \left[B_1^{E,B}(\bar{\gamma})-B_1^{E,B}(\underline{\gamma})\right]-\varepsilon & \text{if } B_1^{I,B}(\bar{\gamma})<\widehat{D}_1^B \le B_1^{E,B}(\underline{\gamma})\\ \theta C_2+(1-\theta)B_1^{E,B}(\bar{\gamma})-B_1^{E,B}(\underline{\gamma})-\varepsilon & \text{if } B_1^{I,B}(\underline{\gamma})<\widehat{D}_1^B \le B_1^{I,B}(\bar{\gamma})\\ (1-\theta)\left[B_1^{E,B}(\bar{\gamma})-B_1^{E,B}(\underline{\gamma})\right]-\varepsilon & \text{if } \widehat{D}_1^B \le B_1^{I,B}(\underline{\gamma}).\end{cases}$$

C. Long-Term Contracts

Suppose an initial bidder borrows long-term debt with D_2 due at date 2 and nothing due at date 1. During period 1, she knows that if she keeps her ability, she receives C_2-D_2. If she loses ability, however, she needs to sell the firm. At date 1, experts in the industry will bid $B_1^{E,s_1}(\gamma_2,D_2)=\min\{\omega_1^{E,s_1}+\max(\gamma_2C_2-D_2,0),C_2-D_2\}$, assuming that all new debt they issue is junior to the original long-term debt (if it were senior, then they would fully dilute it and the incumbent could borrow nothing at date 0). The first term, $\omega_1^{E,s_1} + \max(\gamma_2 C_2 - D_2, 0)$, is industry liquidity and the amount that can still be borrowed with junior debt after D_2 gets repaid. The second term, $C_2 - D_2$, is the value of the firm to acquirers because they need to pay off the debt D_2 at date 2. Therefore, the incumbent's expected payoff after acquiring control of the firm is $\theta(C_2 - D_2) + (1-\theta)[qB_1^{E,G}(\gamma_2, D_2) + (1-q)B_1^{E,B}(\gamma_2, D_2)]$. Clearly, the payoff increases weakly with γ_2 and high pledgeability $\gamma_2 = \bar{\gamma}$ is chosen if $D_2 \leq \bar{\gamma}C_2$. Therefore, the maximum date-2 payment from debt (and therefore the maximum upfront borrowing amount) is $D_2 = \bar{\gamma}C_2$. However, a low-ability manager (or equivalently a financier) can borrow $qB_1^{E,G}(\bar{\gamma}) + (1-q)B_1^{E,B}(\bar{\gamma})$, which clearly dominates $\bar{\gamma}C_2$. Therefore, if initial bidders can only borrow long-term debt without a date-1 payment, a low-ability manager can always raise more than a high-ability manager at the initial date 0. Note that long-term debt without a date-1 payment may enable the expert to raise more than the case when she could only borrow one-period, short-term debt. For example, consider the parameters in Section III.B and further assume that the borrower has no initial liquidity and state B is realized: $\omega_0^E = \omega_1^{E,B} = 0$. In this case, an expert who borrows one-period short-term debt borrows up to $B_0^E(\gamma_1) = D_1^{B,\text{PayIC}}$ as $q \to 0$. Because $\omega_1^{E,B} = 0$, $B_0^E(\gamma_1) = D_1^{B,\text{PayIC}} = [\theta\underline{\gamma} + (1-\theta)\bar{\gamma}]C_2$, which falls below $\bar{\gamma}C_2$, the amount that an expert can raise with long-term debt.

Next, note that long-term debt with positive payments on dates 1 and 2 could possibly raise more for experts than both short-term debt alone and a financier' bids. One such example is if $q \to 1$, the initial bidder sets $D_1 = \omega_1^{E,G} + \gamma_1 C_1$ (assuming $\omega_1^{E,G} < (1-\bar{\gamma})C_2$) and $D_2 = \bar{\gamma}C_2$. This debt structure, if not renegotiated or accelerated (see below), circumvents the moral hazard issues in pledgeability choices (by locking up all future value and preventing increased pledgeability from increasing bids on date 1) and therefore raises $\omega_1^{E,G} + \gamma_1 C_1 + \bar{\gamma}C_2$, exceeding both low types bids $\omega_1^{E,G} + \bar{\gamma}C_2$ and the amount that high types can raise using short-term debt only ($\omega_1^{E,G} + \gamma_1 C_1 + D_1^{G,\text{PayIC}}$ in the case $\omega_1^{I,G} \geq \omega_1^{E,G}$ and $\omega_1^{E,G} + \gamma_1 C_1 + \bar{\gamma}C_2$ in the case $\omega_1^{I,G} < \omega_1^{E,G}$).

However, we now show that whenever the initial expert can raise more by using long-term debt with payments on both dates, she has incentives to default strategically and accelerate all the claims to date 1. To proceed, we assume $D_2 \leq \bar{\gamma}C_2$ without loss of generality. We will show that the incumbent always prefers to strategically default on any contract that raises more than short-term debt, accelerating all claims to date 1, regardless of whether she retains her ability or not. Let us first examine the incumbent's payoff when she retains her ability. If she does not default strategically, her payoff is $C_2 - \min\{\widehat{D}_1^{s_1}, B_1^{E,s_1}(\gamma_2, D_2)\} - D_2$—she needs to pay $\min\{\widehat{D}_1^{s_1}, B_1^{E,s_1}(\gamma_2, D_2)\}$ to retain control of the firm and pay D_2 at date 2 in exchange for the asset's continuation cash flow C_2. If she defaults strategically, she receives $C_2 - \min\{\widehat{D}_1^{s_1} + D_2, B_1^{E,s_1}(\gamma_2, 0)\}$. Clearly, $C_2 - \min\{\widehat{D}_1^{s_1} + D_2, B_1^{E,s_1}(\gamma_2, 0)\} \geq C_2 - \min\{\widehat{D}_1^{s_1}, B_1^{E,s_1}(\gamma_2, D_2)\} - D_2$, so the incumbent would always accelerate the payment and pay (weakly) less overall.

This inequality is strict if $D_2 > \gamma_2 C_2$ and $\omega_1^{E,s_1} < \min\{C_2 - D_2, \widehat{D}_1^{s_1}\}$. Intuitively, if the incumbent accelerates the payments, the total amount that she can repay at date 1 is capped by the bids from experts.

Next, we examine the incumbent's payoff if she loses ability. This payoff is equivalent to one that delivers if she cannot outbid experts even if she keeps her ability. If she does not accelerate the payments, her payoff is $\max\{B_1^{E,s_1}(\gamma_2, D_2) - \widehat{D}_1^{s_1}, 0\}$. If she accelerates, her payoff is $\max\{B_1^{E,s_1}(\gamma_2, 0) - \widehat{D}_1^{s_1} - D_2, 0\}$. We show that these two payoffs are always identical to each other in the relevant cases. Note that $\max\{B_1^{E,s_1}(\gamma_2, D_2) - \widehat{D}_1^{s_1}, 0\} = \max\{\min\{\omega_1^{E,s_1} + \max(\gamma_2 C_2 - D_2, 0) - \widehat{D}_1^{s_1}, C_2 - D_2 - \widehat{D}_1^{s_1}\}, 0\}$ and $\max\{B_1^{E,s_1}(\gamma_2, 0) - \widehat{D}_1^{s_1} - D_2, 0\} = \max\{\min\{\omega_1^{E,s_1} + \gamma_2 C_2 - D_2 - \widehat{D}_1^{s_1}, C_2 - D_2 - \widehat{D}_1^{s_1}\}, 0\}$. If $D_2 < \gamma_2 C_2$, these two payoffs are clearly identical. This is the case if $\gamma_2 = \bar{\gamma}$ has been chosen. Therefore, the only case in which the incumbent might not accelerate debt payments is $\underline{\gamma} C_2 < D_2 < \bar{\gamma} C_2$ and low pledgeability $\gamma_2 = \underline{\gamma}$ has been chosen.[12] In this case, the incumbent could overpromise the payments at date 2 to commit not to accelerate the debt ($D_2 > \underline{\gamma} C_2$). But if so, neither the incumbent nor experts can borrow against the output in period 2. The maximal amount that can be raised ex ante is $q(\gamma_1 C_1 + \omega_1^{E,G}) + (1-q)\omega_1^{E,B} + \underline{\gamma} C_2$, which is dominated by the amount that can be raised by using short-term debt alone (see Sections III.B, III.C, III.D). Therefore, it can never be optimal to set up such a debt structure in the first place.

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[12] In general, the initial incumbent could overpromise payments at date 2, $D_2 > \bar{\gamma} C_2$, which would help her commit not to accelerate payments if she loses her ability and needs to sell the firm. We exclude this possibility as it is public information that the payments due at date 2 can never exceed $\bar{\gamma} C_2$.

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Supporting Information

Additional Supporting Information may be found in the online version of this article at the publisher's website:

Appendix S1: Internet Appendix.