ONLINE APPENDIX

for

Bankruptcy Law and Bank Financing

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1 Reorganization, Liquidation, and the Cost of Bank Financing: Theoretical Framework

This section develops a model of credit in the spirit of Hart and Moore (1994, 1998). The purpose of the model is to derive empirical predictions concerning the relationship between the bankruptcy reforms and bank loans’ interest rates. In particular, the set-up shows that the reorganization reform can increase, and the liquidation reform decrease, the cost of bank financing. The theoretical analysis offers guidance also regarding those firms’ or institutional characteristics that render a firm loans’ cost more responsive to the design of insolvency proceedings.

1.1 Set-up

There are three dates, \( t = 0, 1, 2 \). At \( t = 0 \), a cashless entrepreneur needs funding to set up the physical assets of a firm at the cost of \( K > 0 \). The bank can help the entrepreneur because it has money but no human capital to run the venture. Under entrepreneur’s management, in \( t = 1 \) the assets generate cash flows that depend on the realized state of nature \( \sigma \), which we denote \( y_1(\sigma) \) with \( \sigma \in \{h, l\} \). Specifically, with probability \( p \) the state is \( \sigma = h \), and the value of firm cash flows in \( t = 1 \) is “high” and equal to \( y_1(h) = \bar{y}_1 \). With probability \( (1 - p) \) the state is \( \sigma = l \), the value of \( t = 1 \) cash flows is “low” and given by \( y_1(l) = y_1 \), with \( \bar{y}_1 > y_1 > 0 \). In \( t = 2 \) cash flows are equal to \( y_2 \) with certainty. Moreover, in \( t = 1 \), the physical assets of the firm can be liquidated and yield \( L \), where \( L \) represents the value of the firm’s physical assets in a piecemeal liquidation (or an alternative management), as opposed to the value \( y_2 \) generated by continuation.

Table I presents the distribution of cash flows in each state of nature.

<table>
<thead>
<tr>
<th>( \sigma )</th>
<th>( \Pr(\sigma) )</th>
<th>Cash Flows in ( t = 1 )</th>
<th>Cash Flows in ( t = 2 )</th>
</tr>
</thead>
<tbody>
<tr>
<td>( h )</td>
<td>( p )</td>
<td>( y_1(h) = \bar{y}_1 )</td>
<td>( y_2 )</td>
</tr>
<tr>
<td>( l )</td>
<td>( 1 - p )</td>
<td>( y_1(l) = y_1 )</td>
<td>( y_2 )</td>
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Table I: States of Nature

We assume that the bank and the firm are risk neutral and have symmetric information. Specifically, nobody knows the state \( \sigma \) at \( t = 0 \), but they have perfect knowledge of the state of nature \( \sigma \) at \( t = 1 \). Moreover, the entrepreneur cannot bring leftovers across dates and both investment and liquidation are zero-one decisions. Figure 1 illustrates the timeline of the game.

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1The main implication of this assumption is that the amount granted by the bank will not exceed \( K \) at equilibrium. The standard benefit of extra lending is to provide the entrepreneur with funds to renegotiate and reduce ex-post inefficiencies. In our model, though, ex-post inefficient outcomes never arise at equilibrium.
Following Gennaioli and Rossi (2013), we assume that the entrepreneur can be legally compelled to pay to the bank ex post only a fraction $\alpha \in [0, 1]$ of firm cash flows $y_t(\sigma)$. That is, $\alpha y_t(\sigma)$ is the fraction of observable and verifiable cash flows in date $t$ and state $\sigma$, determining what the entrepreneur can credibly pledge to the bank out of firm cash flows ex ante. The remaining share $(1 - \alpha)$ is retained by the entrepreneur and thus cannot be pledged to the bank. The parameter $\alpha$ captures the degree of investor protection against entrepreneur opportunism or the efficiency of the court in the firm’s district. Indeed, more efficient judicial administration constrains managerial opportunism (Jappelli, Pagano, and Bianco (2005)). As in Hart and Moore (1998), the value of the physical collateral $L$ is fully verifiable.

We solve the model under the following parametric restrictions:

$A1$: $y_2 > L > \bar{y}_1 > \underline{y}_1$.

$A2$: $p(\alpha \bar{y}_1 + L) + (1 - p)(\alpha \underline{y}_1 + L) \geq K$.

$A1$ imposes that cash flows in $t = 2$ are larger than firm assets’ liquidation values, so that it is never ex-post efficient to liquidate the firm. Moreover, it implies that liquidation values are larger than the cash flows in $t = 1$. $A2$ ensures that assets’ liquidation values, $L$, are sufficiently large that liquidation ensures bank’s break even.

For bank financing to occur and the firm to be started, two participation constraints must be satisfied. First, the equilibrium contract must allow the bank to break even. Second, the entrepreneur’s expected payoffs must be positive. Finally, following the definition in Hart (1995), the first best is achieved when the entrepreneur can finance the project, and the liquidation decision is ex-post efficient.

\footnote{Therefore, this model nests the Hart and Moore (1998) assumption of fully unverifiable cash flows, which arises when $\alpha = 0$.}
1.2 Equilibrium Contracts

We solve the model under three scenarios. In the first, we assume that the bank can fully commit to enforce the contract signed at \( t = 0 \) with the entrepreneur. In this environment, the bank never renegotiates the initial contract in \( t = 1 \). Second, we consider the scenario in which commitment is limited, that is, one in which the bank might be tempted to renegotiate the contract in \( t = 1 \). In both scenarios, the entrepreneur is assumed to hold all the bargaining power at \( t = 0 \) and during ex-post renegotiation.\(^3\)

To draw a comparison between these two theoretical scenarios and the pre- and post-reorganization reform periods we note that, before the reorganization reform, legal constraints allowed the bank to commit to the enforcement of financial contracts; thus, we expect that the implied cost of bank financing was as in the scenario featuring full commitment. The reform introduced reorganization procedures that facilitated the renegotiation of loan contracts, thus weakening bank’s capability to enforce the liquidation threat.

We focus on debt contracts. In a debt contract, the firm borrows \( K \) from the bank in \( t = 0 \) and promises to repay \( R_1 \) and \( R_2 \) in \( t = 1 \) and \( t = 2 \), respectively. Repayments will be contingent on the realized state of nature and the firm repayment decision. If the firm repays in full in \( t = 1 \), it is allowed to continue; otherwise, the bank has the right to liquidate the assets and obtain the liquidation proceeds. Given \( A1 \), the optimal contract is such that the firm is never liquidated at equilibrium, thus avoiding ex-post inefficiency. We will show that debt contracts achieve this outcome.

\( R(\sigma) \) is the sum of the equilibrium repayments \( R_1 \) and \( R_2 \) in state \( \sigma \).\(^4\) Moreover, while the risk-free interest rate is zero, we define the interest rate \( 1 + r \) borne by the firm as the ratio between the maximum value of \( R(\sigma) \) set in the financing contract and the initial installment \( K \):

\[
1 + r = \frac{\max\{R(h), R(l)\}}{K}.
\]

Thus, there is a direct relationship between the value of the repayments, \( R(\sigma) \), and the loan interest rate, \( (1 + r) \). We next first derive repayments in the environments with full commitment (\( R^c \)) and limited commitment (\( R^n \)). For our empirical predictions, we compare the ensuing value of the interest rate \( (1 + r) \) in these scenarios.

**Full Commitment** Assume that the contractual terms agreed to in \( t = 0 \) are always enforced and that ex-post renegotiation is unfeasible. The bank will write the contract to discourage strategic default by the entrepreneur, which happens when the entrepreneur

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\(^3\)The assumptions on the bargaining power are standard in the literature (e.g., Hart (1995)). Relaxing them would lead to analogous results as long as the entrepreneur retains a sufficiently strong bargaining position.

\(^4\)This is an abuse of notation, because, although the contractual repayments \( R_1 \) and \( R_2 \) depend on both the firm’s decision to repay and the state of nature \( \sigma \), here we write \( R \) as function of \( \sigma \) only.
fails to repay as much as specified in the contract, even though cash flows are sufficient to pay those debts. The optimal contract then allows the firm to continue after full repayment in $t = 1$ and liquidates the firm after default.

In this scenario, the bank can directly obtain verifiable cash flows of $\alpha y_1(\sigma)$ in $t = 1$ and $\alpha y_2$ in $t = 2$. On top of these amounts, due to the liquidation threat the entrepreneur is willing to pay up to $(1 - \alpha) y_1(\sigma)$ out of $t = 1$ cash flows, and this is affordable to him. Therefore, the entrepreneur at equilibrium is ready to pay to the bank up to $y_1(\sigma)$ in $t = 1$ and $\alpha y_2$ in $t = 2$; which, overall, sum to $y_1(\sigma) + \alpha y_2$ in each state $\sigma$.

Note that the firm is efficiently continued if the entrepreneur repays in full at $t = 1$. Instead, assets are inefficiently liquidated if the entrepreneur defaults strategically (Hart and Moore (1998)). This liquidation threat is credible with full commitment and is important to maximize entrepreneur repayment incentives. Indeed, it is thanks to the liquidation threat that in $t = 1$ the entrepreneur is willing to transfer to the bank $(1 - \alpha) y_1(\sigma)$ on top of the verifiable value of $t = 1$ cash flows ($\alpha y_1(\sigma)$).

But will the firm ever be liquidated at equilibrium? Provided the contractual repayments are feasible, the entrepreneur never defaults and liquidation never takes place at equilibrium. Let us proceed determining these contractual repayments. We assume that

$$A3: \ y_1(\sigma) + \alpha y_2 > K.$$  

By $A3$, the maximum amount the entrepreneur can repay in each state $\sigma$ ($y_1(\sigma) + \alpha y_2$) is larger than $K$. This means that with full commitment the bank can set repayments equal to the capital outlay $K$ independently of the realized state of nature ($R^c(h) = R^c(l) = R^c = K$). These repayments are feasible thus the firm never defaults and the loan is safe to the bank. All this implies that liquidation never occurs on the equilibrium path and the value of the firm reaches the first best. Proposition [1] summarizes this discussion.

**Proposition 1.** With full commitment, the bank sets repayments equal to the capital outlay $K$ in all states of nature (that is, $R^c = K$), so that $r = 0$. The bank breaks even and the value of the firm is as in the first best.

**Proof.** First let us introduce the notation that we use to write the program that parties solve at the contracting stage ($t = 0$). $R_t(\sigma, \rho)$ denotes the date-$t$ contractual repayment, and $\lambda(\rho) \in \{0, 1\}$ is the date-1 liquidation decision. Repayments depend on the realized state of nature, $\sigma \in \{h, l\}$, and the entrepreneur’s repayment decision, $\rho$. Variable $\rho \in \{0, 1\}$ is an indicator taking a value of 1 if the entrepreneur repays in full in $t = 1$, and 0 if the entrepreneur strategically defaults. The liquidation decision only depends on whether the entrepreneur repays at $t = 1$.

\footnote{In the proof, we show that the value of $R^c$ can be spread across periods to satisfy all the relevant constraints.}
With full commitment, the optimal debt contract maximizes entrepreneur expected payoffs,

\[
\max_{\lambda(\sigma, \rho), R_t(\sigma, \rho)} p \{ \bar{y}_1 - R_1(h, 1) + \lambda(1)L + [1 - \lambda(1)] y_2 - R_2(h, 1) \} + (1 - p)\{ y_1 - R_1(l, 1) + \lambda(1)L + [1 - \lambda(1)]y_2 - R_2(l, 1) \},
\]

under the following conditions. First, the entrepreneur participation constraint, which requires that the value of the maximand in [1] at equilibrium must be positive. Then, the bank break-even constraint:

\[
p[R_1(h, 1) + R_2(h, 1)] + (1 - p)[R_1(l, 1) + R_2(l, 1)] = K,
\]

which must hold with equality because the entrepreneur holds all the bargaining power. The objective function in [1] and the break-even constraint in [2] are written setting \( \rho = 1 \), that is, under the condition that the entrepreneur repays in full at \( t = 1 \). To ensure that this is indeed the case in each state \( \sigma \), the following incentive compatibility constraint must hold true:

\[
y_1(\sigma) + \lambda(1)L + [1 - \lambda(1)]y_2 - R_1(\sigma, 1) - R_2(\sigma, 1) \geq y_1(\sigma) + \lambda(0)L + [1 - \lambda(0)]y_2 - R_1(\sigma, 0) - R_2(\sigma, 0).
\]

The left-hand-side of [3] is given by the payoffs of the entrepreneur when the firm repays \( (\rho = 1) \), and the right-hand-side is the entrepreneur payoffs under strategic default \( (\rho = 0) \). Contractual repayments are subject to the following feasibility conditions:

\[
R_1(\sigma, 0) \leq \alpha y_1(\sigma) + \lambda(0)L, \quad R_2(\sigma, \rho) \leq \alpha y_2[1 - \lambda(\rho)].
\]

Finally, the equilibrium first period repayment when \( \rho = 1 \), \( R_1(\sigma, 1) \), is determined by the incentive constraint [3] and must satisfy \( R_1(\sigma, 1) \leq y_1(\sigma) \) (otherwise it would not be feasible). Of course, the firm is started if the value of entrepreneur expected payoffs in [1] is positive.

First note that to minimize entrepreneur payoffs in default, if the entrepreneur does not repay in full \( (\rho = 0) \) the contract sets the highest possible payments: \( R_1(\sigma, 0) = \alpha y_1(\sigma) + \lambda(0)L \) and \( R_2(\sigma, 0) = [1 - \lambda(0)]\alpha y_2 \). Plugging these values into [3] we obtain:

\[
R_1(\sigma, 1) + R_2(\sigma, 1) \leq \alpha[y_1(\sigma) + y_2] + \lambda(1)[L - y_2] + \lambda(0)(1 - \alpha)y_2.
\]

Recall that \( y_2 > L \) under A1. Then, the right-hand-side of [5] is maximized by setting
\( \lambda(0) = 1 \) and \( \lambda(1) = 0 \). That is, the optimal contract liquidates the assets if the firm defaults in \( t = 1 \), but allows the firm to continue otherwise. Plugging the optimal values of the liquidation decisions into (5) yields:

\[
R_1(\sigma, 1) + R_2(\sigma, 1) \leq \alpha y_1(\sigma) + y_2. \quad (6)
\]

Condition (6) shows that with full commitment, the firm is willing pay up to \( \alpha y_1(\sigma) + y_2 \) in each state \( \sigma \). But is this amount feasible for the entrepreneur? Under the optimal contract, the feasibility conditions can be rewritten as follows:

\[
R_1(\sigma, 1) \leq y_1(\sigma), \quad R_2(\sigma, 1) \leq \alpha y_2. \quad (7)
\]

It follows that the entrepreneur cannot repay more than \( y_1(\sigma) + \alpha y_2 \) in each state \( \sigma \), and this amount is smaller than \( \alpha y_1(\sigma) + y_2 \) when \( y_2 > y_1(\sigma) \) (AI). Therefore, the maximum amount that, with full commitment, the entrepreneur can credibly pledge to the bank in state \( \sigma \) is pinned down by the feasibility conditions and equal to \( y_1(\sigma) + \alpha y_2 \).

We now turn to the determination of the per-period repayments. By A2, \( y_1(\sigma) + \alpha y_2 \) is larger than \( K \), thus it always exists a value of the per-period repayments, \( R_t(\sigma, 1) \), such that the break-even condition in (2), the feasibility constraints, and (6) hold true. In particular, if the bank sets \( R_1(\sigma, 1) + R_2(\sigma, 1) = K \) and spreads the per-period repayments so that they are feasible, break even is certain and the loan is safe.\(^6\)

Finally, note that although the optimal contract prescribes firm liquidation in the case of strategic default, liquidation never occurs on the equilibrium path. The reason is that the firm will always have an incentive to repay, so that its value always reaches the first best.

\[ \square \]

**Limited Commitment** Assume now that the institutional environment provides a legal outlet that facilitates contract renegotiation. Will the bank agree to renegotiate after default? What are the consequences of renegotiation on the optimal contract? In the model, renegotiation does not take place when two conditions are met. The first is that the bank has a unilateral incentive to liquidate the firm. The second prescribes that, even though the bank has incentive to enforce the liquidation threat, the entrepreneur cannot bribe it and write a new contract after strategic default.

Let the entrepreneur strategically default in \( t = 1 \). Whether the bank has the incentive to liquidate firm’s assets crucially depends on the continuation value of the firm. Indeed, when what the bank can obtain in \( t = 2 \) by allowing the firm to continue, \( \alpha y_2 \), is smaller

\(^6\)For instance, the contract can set \( R_1(\sigma, 1) = \zeta K \) and \( R_2(\sigma, 1) = (1 - \zeta) K \), with \( \zeta = y_1(\sigma)/(y_1(\sigma) + \alpha y_2) \in (0, 1) \). It is easy to verify that these repayments satisfy all the relevant constraints.
than the liquidation values, \( L \), the bank can credibly commit to pull the plug. In this case, the entrepreneur might still try to bribe the bank, and this bribing is effective only if his resources in \( t = 1 \) are enough to compensate the bank for its decision not to liquidate the assets and obtain \( L \). Specifically, in \( t = 1 \) the entrepreneur can use the value of his cash on hand after repaying \( \alpha y_1(\sigma) \), \((1 - \alpha)y_1(\sigma)\), and pledge to the bank up to \( \alpha y_2 \) out of \( t = 2 \) cash flows. Thus, a sufficient condition for renegotiation not to take place at equilibrium is that \((1 - \alpha)y_1(\sigma) + \alpha y_2 < L\). In this case the entrepreneur cannot convince the bank to waive the liquidation decision and the optimal contract mirrors that of full commitment \((R^n(h) = R^n(l) = R^n = K)\). Otherwise, renegotiation will take place at equilibrium.

Before analyzing the implications of renegotiation on equilibrium repayment and break even, it is important to remark that, under \( A1 \), the left-hand-side of the sufficient condition determining the feasibility of renegotiation is increasing in \( \alpha \). This means, an increase in \( \alpha \) implies that renegotiation is more likely viable. The intuition is that, by increasing the resources a firm can use to convince the bank to renegotiate, stronger investor protection or better courts allow parties to achieve ex-post efficiency. As it will be clear, this result is important for our empirical investigation.

When renegotiation takes place it also reduces what the entrepreneur can credibly repay in each state \( \sigma \). Recall that the entrepreneur holds all the bargaining power in the renegotiation stage, so he will squeeze all the renegotiation surplus and leave the bank indifferent between accepting and rejecting the deal. Hence, the maximum amount that the bank can obtain in each state \( \sigma \) is \( \alpha y_1(\sigma) + L \), which is lower than the maximum repayment with full commitment (i.e., \( y_1(\sigma) + \alpha y_2 \)) when the sufficient condition for the feasibility of renegotiation is met (i.e., when \((1 - \alpha)y_1(\sigma) + \alpha y_2 \geq L)\).

To sharpen the exposition of our results we focus on the comparison between the financing conditions when court efficiency is large (\( \alpha > \bar{\alpha} \)) and renegotiation is always feasible and those when court efficiency is low (\( \alpha < \alpha \)) and renegotiation never takes place.

Even though what the bank can obtain decreases with renegotiation, assumption \( A2 \)

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7 The condition that insures that the entrepreneur cannot bribe the bank \(((1 - \alpha)y_1(\sigma) + \alpha y_2 < L)\) is sufficient for renegotiation not to take place, because it also implies that the bank has unilateral incentive to commit (i.e., \( \alpha y_2 < L \)). The proof of Proposition 2 presents the formal proof of the results that follow.

8 The formulation of \( A1 \) that we employ implies that the left-hand-side of the sufficient condition for the feasibility of renegotiation is strictly increasing in \( \alpha \). More generally, there are two relevant alternative formulations of \( A1 \), and they are weakly increasing in \( \alpha \). In the first \( \max\{y_1(\sigma), y_2\} > L \) and renegotiation is feasible independently of the value of \( \alpha \). Instead, were \( \max\{\hat{y}_1, y_2\} > L > y_1 \) then renegotiation is feasible only when cash flows are “high.”

9 Note that \( \bar{\alpha} \equiv (L - y_1)/(y_2 - y_1) \) and \( \alpha \equiv (L - \hat{y}_1)/(y_2 - \hat{y}_1) \), with \( \bar{\alpha} > \alpha \) under \( A1 \). If \( \alpha \) falls into the \([\alpha, \bar{\alpha}]\) interval renegotiation might be feasible in a state of nature and unfeasible in the other. This means, renegotiation might raise interest payments to a lower extent than when \( \alpha > \bar{\alpha} \).
ensures that break even can be achieved via an appropriate choice of the contractual repayments. Before determining these repayments, we introduce our last parametric restriction:

\[ A_4: \alpha \bar{y}_1 + L > K > \alpha y_1 + L. \]

\[ A_4 \] implies that the maximum amount that the bank can obtain when cash flows are “low” is lower than the initial outlay (\( \alpha y_1 + L < K \)), thus the contractual repayments when cash flows are “high” (\( R^n(h) \)) need to be raised above \( K \) for the bank to break even. Assuming that, by the law, the bank is entitled to extract what the entrepreneur can credibly promise to repay when cash flows are “low” (that is, \( R^n(l) = \alpha y_1 + L \)), the repayments when cash flows are “high” are fixed to satisfy the bank break-even constraint:\[10\]

\[ R^n(h) = \frac{K - (1 - p)(\alpha y_1 + L)}{p}. \] (8)

This value of \( R^n(h) \) is larger than \( K \) but still feasible for the entrepreneur, since it is lower than what the entrepreneur can credibly repay in state \( \sigma = h \) (\( \alpha \bar{y}_1 + L \)). Under these contractual terms, the firm receives funding and repays the due amounts, so the first best is achieved. The following proposition summarizes.

**Proposition 2.** If renegotiation takes place (i.e., \( \alpha > \bar{\alpha} \)), the bank will have to raise the repayments when cash flows are “high” above \( K \) to break even (\( R^n(h) > K \)). If instead renegotiation does not take place (i.e., \( \alpha < \bar{\alpha} \)), the contract mirrors that of full commitment (i.e., \( R^n = R^c = K \)). Then, the interest rate with limited commitment is given by

\[ r = \begin{cases} \frac{R^n(h)}{K} - 1 & \text{if } \alpha > \bar{\alpha} \\ 0 & \text{if } \alpha < \bar{\alpha} \end{cases} \]

In either case, the value of the firm reaches the first best.

**Proof.** This proof closely follows the analysis in Gennaioli and Rossi (2012) Appendix 1, page 629 (Lack of commitment and ex post renegotiation). We first assess whether the threat to liquidate the assets following a \( t = 1 \) strategic default is credible. Specifically, we will give the condition such that lack of commitment arises on the side of the bank. We will proceed by determining whether, although the bank can commit to liquidate, the entrepreneur can still convince it to renegotiate. Finally, we determine the maximum repayments that the bank can obtain in each state \( \sigma \) with and without renegotiation.

\[ \text{The bank is indifferent between any alternative } R^m(l) \text{ that, given } R^m(h), \text{ satisfies the break-even condition. In particular, were } R(l) = R^m(l) \leq R^n(l), \text{ the value of } R^n(h) \text{ that allows the bank to break even needs to be larger than } R^n(h). \text{ That is, if } R^m(l) \leq R^n(l), \text{ then the value of the interest rate with limited commitment and renegotiation will be even larger than if } R(l) = R^n(l). \]
Let the entrepreneur strategically default in \( t = 1 \) (by, say, paying only \( \alpha y_1(\sigma) \) to the bank). The bank can credibly liquidate the firm whenever \( R_2(\sigma, 0) \leq L \); the reason is that what the bank obtains by letting the firm continue is smaller than the liquidation values. If \( \alpha y_2 \leq L \) this condition is naturally satisfied, so that the bank will always prefer to liquidate the firm’s assets after default. Conversely, if \( \alpha y_2 > L \) the contract sets \( R_2(\sigma, 0) = L \) and the the bank will always be willing to renegotiate.

Before proceeding, we need to determine whether, even though the bank has the unilateral incentive to liquidate firm’s assets \( (\alpha y_2 \leq L) \), the entrepreneur can convince the bank to renegotiate. First note that after repaying \( \alpha y_1(\sigma) \) entrepreneur’s cash on hand in \( t = 1 \) is equal to \( (1 - \alpha)y_1(\sigma) \). Then recall that by letting the firm continue the bank obtains at most \( \alpha y_2 \) in \( t = 2 \), whereas by pulling the plug the bank obtains \( L \) in \( t = 1 \). This means that the entrepreneur can convince the bank to renegotiate the liquidation decision if, and only if, \( (1 - \alpha)y_1(\sigma) \geq L - \alpha y_2 \), or \( (1 - \alpha)y_1(\sigma) + \alpha y_2 \geq L \). Instead, when \( (1 - \alpha)y_1(\sigma) + \alpha y_2 < L \) bribing the bank is never feasible for the entrepreneur.

This discussion gives rise to three cases. In the first \( \alpha y_2 \leq L \) and \( (1 - \alpha)y_1(\sigma) + \alpha y_2 < L \), so that the bank has no unilateral incentive to renegotiate and the entrepreneur has not enough resources to bribe it. In the second \( \alpha y_2 \leq L \) and \( (1 - \alpha)y_1(\sigma) + \alpha y_2 \geq L \), so that the liquidation threat is credible, but the entrepreneur can always convince the bank to renegotiate and write a new contract. In the third, \( \alpha y_2 > L \) and the bank will always renegotiate.

In the first case the entrepreneur repayment incentives are as with full commitment, see Proposition 1 and the optimal contract mirrors that of full commitment \( (R^n(h) = R^n(l) = R^n = K) \). In the remaining two cases we need to study the renegotiation game under the assumption that \( (1 - \alpha)y_1(\sigma) + \alpha y_2 \geq L \), as this is the sufficient condition to trigger renegotiation. Recall that the entrepreneur holds the bargaining power in the renegotiation stage, implying that he will squeeze the renegotiation surplus in full and leave the bank with \( L \). There, therefore, the bank’s maximum total repayment in each state \( \sigma \) with renegotiation is equal to \( \alpha y_1(\sigma) + L \), which is lower than the maximum amount under full commitment \( (y_1(\sigma) + \alpha y_2) \) when, as in the cases we are considering, \( \alpha y_1(\sigma) + L \leq y_1(\sigma) + \alpha y_2 \).

Before determining the value of the contractual repayments, to sharpen the exposition of our results we exclude those values of \( \alpha \) such that renegotiation might be feasible in a state of nature and unfeasible in the other. Specifically, we assume that \( \alpha \) can either be larger than \( \tilde{\alpha} \equiv (L - y_2)/(y_2 - y_1) \) or lower than \( \alpha \equiv (L - \tilde{y}_1)/(y_2 - \tilde{y}_1) \), with \( \tilde{\alpha} > \alpha \) under

\[^{11}\]To clarify the role of bargaining power in the renegotiation stage, suppose that renegotiation occurs according to a standard Nash bargaining protocol in which the bargaining power of the entrepreneur is equal to \( e \in [0, 1] \). Then the bank obtains at most \( \alpha y_1(\sigma) + eL + (1 - e)[\alpha y_2 + (1 - \alpha)y_1(\sigma)] \) in state \( \sigma \). Setting \( e = 1 \) yields our results.

9
$A1$: when $\alpha < \alpha$ renegotiation is never feasible (because $(1-\alpha)y_1 + \alpha y_2 < L$ when $\alpha < \alpha$), whereas when $\alpha > \bar{\alpha}$ renegotiation always takes place (because $(1-\alpha)y_1 + \alpha y_2 > L$ when $\alpha > \bar{\alpha}$).

We now pin down the values of the repayments, $R_1(\sigma, \rho)$ and $R_2(\sigma, \rho)$, when renegotiation happens ($\alpha > \bar{\alpha}$). The maximum value of $R_1(\sigma, 0) + R_2(\sigma, 0)$ is determined by (3), so as to maximize entrepreneur repayment incentives, under the assumption that the liquidation policy is not renegotiation-proof ($\lambda(0) = 0$). $R_1(h, 1)$ and $R_2(h, 1)$ are chosen so to allow the bank to break even. Indeed, even though renegotiation reduces what the bank can obtain in each state $\sigma$, by $A2$ the bank will still be able to break even. Moreover, since $\alpha y_1 + L < K$ (by $A4$), the bank will not be able to set the repayments as in the case with full commitment. This means, it will have to raise the value of the repayments in state $\sigma = h$ to break even.

Assume that, by the law, the bank is entitled to extract $\alpha y_1 + L$ in state $\sigma = l$, then it fixes $R_1(h, 1)$ and $R_2(h, 1)$ to satisfy its break-even condition:

$$R_1(h, 1) + R_2(h, 1) = \frac{K - (1-p)(\alpha y_1 + L)}{p}. \quad (9)$$

The value of $R_1(h, 1) + R_2(h, 1)$ in (9) is larger than $K$; however, it is lower than $\alpha y_1 + L$. In analogy to the case with full commitment analyzed in the proof of Proposition 1, it is always possible to write the per-period repayments $R_1(h, 1)$ and $R_2(h, 1)$ so as to satisfy the feasibility conditions. Therefore, liquidation never occurs on the equilibrium path and the first best is attained.

To conclude, we provide the comparative statics analysis of the expression in (9) with respect to $L$ and $p$. Specifically, the derivative of (9) with respect to $L$ is equal to $-(1-p)/p < 0$, and the derivative with respect to $p$ is given by

$$\frac{\partial (R_1(h, 1) + R_2(h, 1))}{\partial p} = \frac{(\alpha y_1 + L) - K}{p^2},$$

which is clearly negative by $A4$.

**Discussion** A direct consequence of Proposition 2 is that a firm’s interest rate increases when the bank’s liquidation threat is not credible. In particular, the interest rate will remain zero if parties do not renegotiate and rise to a value that is larger than zero

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12 In fact, the bank is indifferent between any value of $R_1(l, 1) + R_2(l, 1)$ that, given the repayments in state $\sigma = h$, satisfies the break-even condition. In particular, were $R_1(l, 1) + R_2(l, 1)$ to be lower than $\alpha y_1 + L$, then the value of the repayments in state $\sigma = h$ that allows the bank to break even needs to be larger than in (9).
\[ (R^n(h)/K - 1) \text{ otherwise.} \]

The analysis of the limited commitment scenario yields \textit{comparative statics} that will be useful for our empirical analysis. First, as already remarked above, renegotiation happens when the value of \( \alpha \) is relatively large, or, following our interpretation of \( \alpha \), when courts are more efficient. Second, the value of the repayments in (8) decreases with the liquidation value of the firm \( (L) \) and the likelihood that cash flows are “high” \( (p) \). Intuitively, if liquidation values rise the value of the repayments in (8) shrinks, because the bank can extract more when cash flows are “low.” At the same time, as the probability that cash flows are “high” increases, the risk of default is lower and therefore the bank reduces the value of the repayments.

\textbf{Renegotiation and Firm Value} We conclude this section by discussing the implications of our results for firm value. In the environments that we have considered, the firm always receives funding and liquidation never occurs at equilibrium. Thus, firm value will always be equal to the first best, and we can just focus on the effects of renegotiation on interest rates. Our model then predicts that renegotiation reduces what the entrepreneur can credibly repay, thus forcing the bank to increase payments in order to break even. However, renegotiation does not alter firm value.

Assumption \textit{A2} is crucial to draw this conclusion. If the inequality in \textit{A2} were binding for some of the parameters’ value, there might be valuable projects that would not receive funding when commitment is limited. In this case, renegotiation not only changes the interest rates on bank loans but also introduces a dead-weight loss.

\textbf{References}


\textsuperscript{13}Formal calculations are in the proof of Proposition 2.