Loan Sales and Relationship Banking

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ABSTRACT

Firms raise money from banks and the bond market. Banks sell loans in a secondary market to recycle their funds or to trade on private information. Liquidity in the loan market depends on the relative likelihood of each motive for trade and affects firms' optimal financial structure. The endogenous degree of liquidity is not always socially optimal: there is excessive trade in highly rated names, and insufficient liquidity in riskier bonds. We provide testable implications for prices and quantities in primary and secondary loan markets, and bond markets. Further, we posit that risk-based capital requirements may be socially desirable.

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The term "Collateralized Loan Obligation" (CLOs) was coined in 1989, when corporate loans were first used as collateral in Collateralized Debt Obligations (CDOs).[1] Since then, the growth in loan sales has been enormous. According to Lucas, Goodman and Fabozzi (2006), $1.1 trillion of CDOs were outstanding as of 2005, and 50% of their collateral was comprised of loans. In addition to pooled securities, banks also trade first loss positions on single names through direct sales of individual loans. In the U.S., loan sales have grown from $8 billion in 1991 to $154.8 billion by 2004.[2] If a bank securitizes or sells a loan that it originated, it is buying insurance on credit events over which it has either more control or more information than the buyer.

In the face of this informational friction, why did the secondary market for corporate loans develop in the 1990s? What effect has this had on relationship banking? In this paper, we characterize when a liquid secondary market for loans arises, when a liquid secondary loan market is socially desirable, and we provide testable predictions on the effect of the emergence of this market on prices and quantities in bond and primary loan markets. Our predictions are based on both changes in the parameters that lead to higher loan liquidity and changes in the contracts that are written between banks and firms given this higher liquidity.

Two views on the rise of active credit risk management by banks have been proposed. First, more liquid bank assets make asset-liability management easier. Banks can quickly redeploy capital to more profitable business opportunities and are more resilient to negative shocks, as in Greenspan (2004) and Schuermann (2004). Following this view, active secondary loan markets are socially beneficial. Second, and more perniciously, banks can now unbundle balance sheet management from borrower relationship management. This may reduce banks' incentives to monitor and foster a relationship with the borrower, and

ultimately create a shift from relationship banking to transaction-oriented banking (a view espoused by Effenberger (2003); Kiff and Morrow (2002), and Rule (2001) among others). If relationship banking adds value, then loan liquidity may be harmful. We demonstrate that with endogenous loan liquidity, either of these cases can obtain.

In our stylized model, a firm has a risky, positive-NPV long-term project that can be financed with the firm's own equity or from two outside sources, namely, a bank and the bond market. The optimal financing mix maximizes the firm's return on equity subject to the resolution of a moral hazard problem: the firm may shirk, which reduces the project's success probability. A bank adds value because it can reduce a firm's incentive to shirk. However, through monitoring, banks gain private information about the project's success. After monitoring, a bank may receive an attractive outside investment opportunity and wish to redeploy its funds. An active secondary market gives the bank the flexibility to recycle capital. However, a liquid market may also reduce a bank's incentive to monitor as it could also sell non performing loans. The impact of an active secondary loan market on banks and firms depends on this trade-off between a lower monitoring incentive and the increased flexibility offered by this market.

In our model, banks differ from the bond market in three ways. First, banks are better able to monitor the firm than the bond market. This could be because bondholders are typically dispersed and thus individually have a smaller incentive to monitor. Second, while monitoring, the bank learns about the success or failure of the project. Thus, in our model monitoring both resolves the moral hazard problem and generates proprietary information for the bank. Many of our results are driven by these joint assumptions. Finally, we posit that banks have a preference for liquid assets.

The assumption that lending generates proprietary information about the borrower is

common in the banking literature (Rajan (1992)), and well documented empirically (e.g., Lummer and McConnell (1989)). In our setting, however, the acquisition of material information is an ineluctable but adverse consequence of monitoring.[3] Thus, there is a tension between monitoring and the tradeability of the bank's risks, which in turn makes monitoring costly if the bank values flexibility. This assumption captures the intuition that an important part of the information that a bank acquires in order to monitor the firm also helps to predict the firm's future performance, and cannot be credibly communicated to outsiders. Examples of such information include the assessment of the top management's character, or an understanding of the allocation of real authority within the firm. This type of information is essentially soft, and acquired by the loan officer through ongoing personal interaction with the top management. Other examples of information that is necessary for monitoring purposes but cannot be made publicly available include the trade secrets that generate a project's value and whose disclosure would erode competitive advantage.

Liquidity is valuable in our model because a loan on its balance sheet may prevent a bank from exploiting private redeployment opportunities,either due to insufficient liquidity or binding capital adequacy requirements. The secondary loan market is only liquid if adverse selection risk is sufficiently low. A bank that has monitored a firm knows if the project will succeed or fail. Thus, investors do not know if the bank is shedding risk because of outside investment opportunities, or because of inside information. If the adverse selection problem is too severe, trading in the secondary market breaks down as in Akerlof (1970) and all loans are illiquid. However, if the probability that the bank is selling its loan for private motives is sufficiently high then there is pooling and the market is liquid. Possible inside trading by banks in the secondary credit market is reported in the popular press as a concern among practitioners.[4] Altman, Amar and Saunders (2004) find that returns in the

secondary market for loans lead bond and stock returns around important credit events.

Although the rise of an active loan market is socially efficient ex post, it may not be socially desirable ex ante. A liquid market has two opposite effects on the cost of bank debt. On one hand, interest rates on loans are smaller because the bank no longer charges a liquidity premium. On the other hand, the incentive compatible stake of the bank in the project increases, because the ability to benefit from inside trading reduces the bank's incentives to monitor ex ante. In sum, firms must borrow more from banks, albeit at a lower price, if there is a liquid loan market.

Our model has a number of testable implications. We first observe that the credit spread in the secondary loan market is not the unconditional probability that the reference entity will default: rather, it is the probability of default conditional on a bank's willingness to sell. The unconditional and conditional probabilities differ systematically with a firm's default probability, thereby generating an observed liquidity premium in the secondary market.

The rest of our testable implications relate prices and quantities in bond and primary loan markets after a secondary loan market has arisen. We posit that the secondary market arose because of regulatory changes in the early 1990s. First, we predict that secondary trading volume should be larger for high-grade names. Second, a larger trading volume implies that bank loans and privately placed debt crowd out public bonds in firms' total debt issuances. Third, a liquid loan market is efficient, namely, increases firms' total debt capacity, only if the firm is not too highly rated. Fourth, as the secondary market arises due to a real shock to bank capital, all bank loans are affected and the prices become more sensitive to credit risk for all ratings.

Gorton and Pennacchi (1995) and Pennacchi (1988) study incentive compatible loan sales contracts that provide the bank with incentives to keep monitoring the borrower after

having sold the loan. Loan liquidity is always desirable and second-best efficient in their setups. This paper focuses instead on the impact of such ex post efficient sales on the incentives of the bank to monitor the borrower ex ante. We show that liquidity may rise in the secondary loan market even though this is ex ante inefficient.

Our basic model of moral hazard is adapted from Holmstrom and Tirole (1997). Our work is also related to that of Maug (1998), and Kahn and Winton (1998). We defer a discussion of these papers to Section V. In non banking contexts, Aghion, Bolton, and Tirole (2004), and Faure-Grimaud and Gromb (2003) develop models in which an impatient agent markets claims to her future output. The informational efficiency of the market is an important incentive device for the agent. By contrast, in our model liquidity makes incentives more difficult to enforce because in a liquid market, the bank trades with uninformed agents.

We provide a description of the model in Section I, followed by a characterization of the optimal contracts in Section II. We establish the conditions under which a liquid loan market is socially efficient and those under which it is liquid in Section III. The cross-sectional implications of our model are presented in Section IV. We discuss robustness and extensions in our conclusion, Section V. All proofs appear in the appendix.

I. Model

In an economy with three dates, $t = 0, 1$, and 2, there are three classes of agents: a firm, a bank, and a large pool of competitive investors. All agents are risk neutral and are protected by limited liability.[5] Neither the investors nor the firm discount future cash flows.

The firm owns the rights to a two-period constant returns to scale project. Every dollar

invested in the project at $t = 0$ has a random date 2 payoff of R with probability p, or zero with probability $1 - p$. The firm also has initial equity or net assets, A. In addition to investing its own assets in the project, the firm can solicit additional funds from the bank and the outside investors. To do so, the firm offers each group a contract at $t = 0$. The firm's objective is to maximize expected return on equity.

This simple specification allows us to abstract from security design issues in order to focus on prices and volumes in bond and loan markets. A large literature explains the benefits from pooling risks in security issuances plagued by informational asymmetry.[6] We discuss the implications of a more general stochastic structure in Section V.

Some actions taken by the firm are not observable to outside investors. In particular, after raising outside funds, the firm may "shirk" and derive a private benefit B_F per dollar invested at $t = 1$. In this case, the project fails and pays off zero at date 2. This moral hazard problem means that financial structure matters.

Active monitoring at $t = 0$ by the bank reduces the firm's private benefit per unit of investment from shirking to $b_F < B_F$. Monitoring is costly for the bank as it loses a private benefit B_B per dollar of the project associated with not monitoring.[7] An additional consequence of monitoring is that, through its relationship with the firm, the bank acquires private information about the project. For simplicity, we assume that private information is perfect: if the bank monitors, it learns the project's outcome at date 1.

Our main departure from Holmstrom and Tirole (1997) is the assumption that the bank maximizes a utility function with a stochastic discount factor. At $t = 0$, the utility of a bank is

$$U^B(c_0, \widetilde{c_1}, \widetilde{c_2}) = E(c_0 + \delta_1 \widetilde{c_1} + \delta_1 \widetilde{\delta_2} \widetilde{c_2}),$$

where $\delta_1 \in (0, 1)$ and $\widetilde{\delta_2}$ is a two-point random variable whose realization at date 1 is

$$\tilde{\delta_2} \quad = \quad \begin{cases} \delta \in (0,1) & \text{with probability} \quad q \\ 1 & \text{with probability} \quad 1-q. \end{cases}$$

The bank's realization of $\widetilde{\delta_2}$ at date 1 is *private information*.[8]

The stochastic discount factor $\widetilde{\delta_2}$ proxies for unanticipated changes in the opportunity cost of carrying outstanding loans. More precisely, it captures the idea that the bank receives new private opportunities to invest with other borrowers or nonlending business, but may be unable to seize them if it has insufficient liquid assets or binding capital adequacy ratios. We discuss the interpretation of δ in more detail below.

After the bank has received her discount factor shock and learned the realization of the project, we assume that she can offer new contracts to the investors.[9] The timeline is presented in Figure 1.

<<Figure 1 About here >>

The assumption that the bank only monitors during the first period is for simplicity. An additional moral hazard problem during period 2 would complicate the analysis without offering any further insights. We note in passing that this first period need not be long. "Monitoring" may mean, for example, restricting the initial choice of assets made by the firm. Thus, our model could apply to situations in which the bank sheds risk shortly after having originated the loan.

To interpret the stochastic discount factor, suppose that the bank receives a private investment opportunity with an expected rate of return of μ, but does not hold enough liquid assets to undertake the new investment. In this case, the opportunity cost of carrying an

outstanding claim to a date 2 unit payment, instead of selling it and investing the proceeds in the redeployment opportunity, implies a discount of

$$\delta = \frac{1}{1+\mu}.$$

In addition to liquidity risk, binding capital adequacy ratios are also often mentioned as a motive for loan sales (Saunders and Cornett (2006)). Assume that the bank has a binding solvency ratio at date 1. Suppose that the capital requirement associated with a claim is $\kappa\%$.[10] Then, selling this claim frees up κ cents of regulatory capital at date 1. The opportunity cost of retaining the loan is therefore

$$\delta = \frac{1}{1+\mu\frac{\kappa'}{\kappa}},$$

where $\kappa'\%$ is the capital requirement that applies to the redeployment opportunity.

We restrict the analysis to renegotiation-proof contracts. This distinguishes our paper from Aghion, Bolton, and Tirole (2004), who assume full commitment in a related framework. We assume that all random variables are independent. To ensure interior solutions we impose additional parameter restrictions when we solve for the optimal contracts.

II. Characterization of the Optimal Contracts

We characterize the optimal renegotiation-proof contracts offered by the firm at $t = 0$ to the different creditors, and restrict the analysis to situations in which the firm needs bank financing. Before we characterize the optimal contracts that a firm offers to the bank and

outside investors at time 0, we study the loan sale negotiated by the bank at time 1.

A. Spreads in the Secondary Loan Market

At $t = 1$, there are possible gains from trade between a bank with a high opportunity cost of carrying the loan and outside investors. The bank may sell its claim on date 2 cash flows at date 1. At this time the bank has two pieces of private information: The opportunity cost of the loan, $\widetilde{\delta}_2$, and knowledge of whether the firm's project has succeeded or failed. Recall that a failed project pays off zero. Thus, a bank with a claim to a failed project will sell future cash flows at any positive price. Observe that limited liability precludes signalling in this market. A bank holding a defaulted loan is willing to mimic any contract that does not involve negative payments.[11]

If the only motive for trade in the secondary market is to dispose of failed projects, then the price must be zero.[12] We term such a market illiquid. Alternatively, the price could be such that a bank with a liquidity shock would also be willing to sell the loan. We deem such a market to be liquid.

DEFINITION **1** *The secondary loan market is liquid if a bank with a preference shock ($\widetilde{\delta}_2 = \delta$) is willing to sell both failed and successful claims. A secondary market is illiquid if such a bank is only willing to sell failed claims.*

If the market is liquid, then investors believe that the bank is selling either because the project failed (which occurs with probability $1 - p$) or that the project succeeded but the bank received an attractive outside opportunity. This occurs with probability pq. Thus, if the market is liquid, outside investors value one promised date 2 dollar at a price r, where

$$r = \frac{pq}{1 - p + pq}.$$

Notice that $r < p$, the unconditional probability that the project succeeds. The loan spread in the secondary market incorporates an adverse selection discount. The spread is not given by the unconditional default probability $(1-p)$; rather, it reflects the probability that the firm defaults conditional upon the fact that the bank is willing to sell the risk. This is always weakly higher than the unconditional default probability. Figure 2 depicts the default probability and the spread in the secondary market.

<< Figure 2 about here >>

Let $\Delta(p)$ denote the difference between the promised spread in the secondary market and the unconditional default probability:

$$\begin{aligned}\Delta(p) &= (1-r)-(1-p) \\ &= \frac{(1-p)\,p(1-q)}{1-p+pq} \\ &\geq 0.\end{aligned}$$

Thus, $\Delta(p)$ is the "liquidity premium," or that part of the promised loan spread that is not explained by *prior* default probabilities.

LEMMA **1** *: If the loan market is active, then*

(i) The liquidity premium, $\Delta(p)$ is concave in p, the unconditional probability of no-default.

(ii) The ratio of the liquidity premium to the unconditional default probability, $\frac{\Delta(p)}{1-p}$, is increasing in the credit rating p.

In other words, an econometrician comparing historical defaults $(1-p)$ and spreads in the secondary loan market $(1-r)$ would find a "liquidity premium," $\Delta(p)$, unexplained

by historical defaults. She would also find that this premium is a higher fraction of the total spread for higher credit ratings. This qualitative feature is broadly consistent with the empirical findings of Berndt et al. (2005) in another secondary credit market, the credit default swap market. Intuitively, the liquidity spread is an adverse selection discount that depends on the bank's informational advantage. The size of this depends on the *variance* of the *prior* ($p(1-p)$). By contrast, the unconditional spread depends only on its mean. The expected credit losses decrease faster than their variance as p increases.

B. Characterization of Optimal Contracts

The contracts offered by the firm at date 0 differ if participants anticipate a liquid loan market. To characterize the optimal contracts, we consider two cases depending on whether an active secondary loan market can exist. Recall the firm has assets A and owns a project that generates a return per unit of investment of R with probability p, and zero with probability $1-p$. For a given investment size, I, the firm pledges a portion of the final payoff to the bank, $R_B I$, to secure a loan of size L, and another portion to the market, $R_M I$, to secure a bond issue of size M. The firm retains a portion $R_F I$ and maximizes expected profits $\pi^F = pR_F I - A$ by choosing $\{I, L, M, R_F, R_B\}$.

If there is no active secondary loan market, the firm chooses a contract:

$$
\begin{aligned}
Max_{I,L,M,R_F,R_B} \quad & \{pR_F I - A\} \\
& s.t. \\
pR_F &\geq b_F && (1) \\
\delta_1 E \delta_2 p R_B &\geq B_B && (2) \\
\delta_1 E \delta_2 p R_B I &\geq L && (3)
\end{aligned}
$$

$$
\begin{aligned}
p\underbrace{(R - R_F - R_B)}_{R_M} I &\geq M && (4)\\
I &\leq M + A + L && (5)\\
I, L, M, R_F, R_B &\geq 0. && (6)
\end{aligned}
$$

Conditions (1) and (2) are the incentive compatibility constraints of the firm and the bank, respectively. Equation (1) ensures that the firm, if monitored, will not shirk. If the firm does not shirk, then it receives a payoff of $pR_F I$, whereas if it shirks and is monitored by the bank the payoff is $b_F I$. Condition (2) ensures that the bank's payoff is higher if it monitors the firm than if it does not. Specifically, if the bank does not monitor, it consumes private benefits proportional to the size of the project: $B_B I$. If the bank does monitor the firm, then it receives a promised payoff of $R_B I$ with probability p. The time $t = 1$ value of this expected payout depends on the realization of the bank's discount factor between $t = 1$ and $t = 2$: The date 0 expected value of the discount factor is $E\delta_2$. Further, the bank discounts any cash flows between $t = 1$ and $t = 0$ at δ_1. Conditions (3) and (4) are the participation constraints of the bank and the outside investors. Condition (5) is a resource constraint.

LEMMA **2** : *Suppose that there is no active loan market. If* $1 + B_B \frac{1-\delta_1 E\delta_2}{\delta_1 E\delta_2} < pR < 1 + B_B \frac{1-\delta_1 E\delta_2}{\delta_1 E\delta_2} + b_F$, *then the expected profits to the firm,* $\pi^F(p)$, *the project size,* $I(p)$, *the amount borrowed from the bank,* $L(p)$, *and the amount borrowed from the market,* $M(p)$, *are*

$$
\begin{aligned}
\pi^F(p) &= \frac{pR - 1 - B_B(\frac{1-\delta_1 E\delta_2}{\delta_1 E\delta_2})}{1 - pR + b_F + B_B(\frac{1-\delta_1 E\delta_2}{\delta_1 E\delta_2})} A\\
I(p) &= \frac{A}{1 - pR + b_F + B_B(\frac{1-\delta_1 E\delta_2)}{\delta_1 (E\delta_2)})}\\
M(p) &= I(p)(1 - B_B) - A\\
L(p) &= B_B I(p).
\end{aligned}
$$

The term $B_B(\frac{1-\delta_1 E\delta_2}{\delta_1 E\delta_2})$ in the denominator of $I(p)$ is the unit rent that accrues to the bank. Together with the firm's unit informational rent b_F, this reduces the fraction of the unit surplus $pR-1$ that can be pledged to outside investors, thereby capping total investment size I.

Now, suppose that an active secondary market exists and a bank can sell claims to $t=2$ cash flows at a price r at date 1. The firm then solves:

$$
\begin{aligned}
Max_{I,L,M,R_F,R_B} \quad & \{pR_F I - A\} \\
& s.t. \\
pR_F &\geq b_F \\
\delta_1 pR_B &\geq B_B + \delta_1 rR_B \qquad (7) \\
L &\leq \delta_1 pR_B I \qquad (8) \\
p(R-R_F-R_B)I &\geq M \\
I &\leq M+A+L \\
I, L, M, R_F, R_B &\geq 0.
\end{aligned}
$$

The existence of a liquid market changes the bank's incentive compatibility and participation constraints (7) and (8) through changes in its discount factor. First, consider the payoff to the bank that monitors the firm: $\delta_1 pR_B I$. The bank has been promised $R_B I$ if the project succeeds. The bank can sell the claim at $t=1$ if it finds out the project has failed or if it receives a discount factor shock. Thus, with probability $(1-p+pq)$ the bank sells its claim at price $r=\frac{pq}{1-p+pq}$. With probability $p(1-q)$, it will not sell its claim but values it at a discount rate of one. Thus, the expected value of a dollar promised at $t=2$ is

p, which the bank discounts to $t = 0$ at δ_1. If the bank shirks (the right-hand side of (7)), it receives private benefits of $B_B I$. In addition, it knows that the project has failed. It can therefore sell its promised payment of $R_B I$ at a price of r in the loan market. The $t = 0$ value of this sale is $\delta_1 r R_B I$.

The change in expected discount rate affects a bank's behavior through both the participation and the incentive compatibility constraints. It is instructive to compare these new constraints to those that obtain without a liquid loan market, namely, constraints (2) and (3). The bank's participation constraint is easier to meet with this higher discount factor because the cost of bank capital is lower: The price of the loan no longer features the liquidity premium $E\delta_2$. However, the impact of a liquid market on the incentive compatibility constraint is ambiguous. First, the bank does not require a liquidity premium on date 2 cash flows. This reduces the cost of incentives. However, a bank that does not monitor and consumes private perquisites can now sell the worthless loan at the pooling price. This makes shirking more attractive and thus the IC may be more difficult to satisfy. We demonstrate in Section III that the optimal solution to this problem is to take out proportionally larger loans from the bank. In sum, with an active secondary loan market, the firm needs to borrow *larger quantities* from the bank, but each dollar is borrowed at a *lower price*.

LEMMA **3** *: Suppose that there is a liquid loan market. If* $\max\left[b_F + B_B\left(\frac{1}{\delta_1}\right)\frac{p}{p-r}; 1 + B_B\frac{p}{p-r}\frac{1-\delta_1}{\delta_1}\right] < pR < 1 + B_B\frac{p}{p-r}\frac{1-\delta_1}{\delta_1} + b_F$*, then the surplus to the firm,* $\pi^F(p)$*, the size of the project,* $I(p)$*,* $M(p)$*, and* $L(p)$ *are*

$$\begin{aligned}
\pi^F(p) &= \frac{pR - 1 - B_B(\frac{p}{p-r})\left(\frac{1-\delta_1}{\delta_1}\right)}{1 - pR + b_F + B_B(\frac{p}{p-r})\left(\frac{1-\delta_1}{\delta_1}\right)} A \\
I(p) &= A\left(\frac{1}{1 - pR + b_F + B_B(\frac{p}{p-r})\left(\frac{1-\delta_1}{\delta_1}\right)}\right)
\end{aligned}$$

$$
\begin{aligned}
L(p) &= B_B \left(\frac{p}{p-r} \right) I(p) \\
M(p) &= I(p) \left(\frac{(1-B_B)p - r}{p-r} \right) - A,
\end{aligned}
$$

where $B_B(\frac{p}{p-r}) \left(\frac{1-\delta_1}{\delta_1} \right)$ is the bank's ex ante rent in presence of a liquid market.

C. Parameter Restrictions:

Lemmas 2 and 3 present solutions to the model under the respective parameter restrictions:

$$
1 + B_B \frac{1 - \delta_1 E \delta_2}{\delta_1 E \delta_2} < pR < 1 + B_B \frac{1 - \delta_1 E \delta_2}{\delta_1 E \delta_2} + b_F,
$$

if there is no active market, and

$$
\max \left[b_F + B_B \left(\frac{1}{\delta_1} \right) \frac{p}{p-r}; 1 + B_B \frac{p}{p-r} \frac{1-\delta_1}{\delta_1} \right] < pR < 1 + B_B \left(\frac{p}{p-r} \right) \frac{1-\delta_1}{\delta_1} + b_F,
$$

if loan sales are possible. In both cases, the left-hand inequality ensures that the project's NPV is sufficiently high so that the firm can borrow from the bank and the market, and that bank monitoring is feasible. The right-hand inequality bounds the NPV so that the optimal investment size is finite. When we perform comparative statics we assume that these conditions hold; effectively, B_B is sufficiently small and b_F is sufficiently large. For a fixed R, the conditions restrict default probabilities $(1-p)$ to a small range. Empirically, Hamilton (2001) finds that average 5-year cumulative default rates for investment-grade names are 0.82% and 18.56% for speculative names. Thus, the interval of default probabilities that we consider is small.

III. Liquidity and Efficiency

By assumption, the bank and bondholders are always held to their participation constraints. Thus, social surplus is maximized when the firm makes the highest profit. Given the constant returns to scale technology, profits are maximal when the size of the project, $I(p)$, is maximal. Equivalently, social efficiency demands that a firm borrows as much as possible.

Recall that

$$I(p) = A \begin{cases} \frac{1}{1-pR+b_F+B_B\frac{1-\delta_1 E\delta_2}{\delta_1 E\delta_2}} & \text{if the loan is illiquid} \\ \frac{1}{1-pR+b_F+B_B\frac{p}{p-r}\frac{1-\delta_1}{\delta_1}} & \text{if the loan is liquid} \end{cases}$$

Thus, a liquid secondary loan market is socially efficient if the bank's unit rent is smaller when there is active loan trading:

$$B_B\frac{p}{p-r}\frac{1-\delta_1}{\delta_1} < B_B\frac{1-\delta_1 E\delta_2}{\delta_1 E\delta_2}.$$

To study the impact of loan liquidity on the bank's rent, note that we derive I from equality (5), the condition that bondholders make zero profits:

$$I(p) - A - L = pRI(p) - b_F I(p) - pR_B I(p).$$

Rearranging yields

$$I(p) = \frac{A}{1 - pR + b_F + \frac{pR_B I(p) - L}{I(p)}}.$$

The bank's rent, $\frac{pR_B I(p)-L}{I(p)}$, can be decomposed into

$$\frac{pR_B I(p) - L}{I(p)} = r_B(p) f_B(p),$$

where

$$r_B(p) = \frac{pR_B I(p) - L}{L}$$

is the time 0 expected rate of return on a bank loan and

$$f_B(p) = \frac{L(p)}{I(p)}$$

is the fraction of the project funded by a bank loan.

A liquid loan market is efficient if and only if $r_B(p)f_B(p)$, the expected cost of a bank loan per unit investment, is smaller if the market is liquid. As indicated in the previous section, this need not be the case. The existence of a liquid market has two countervailing effects on $r_B(p)$ and $f_B(p)$. On one hand, with an active market the bank no longer demands a liquidity premium as it discounts $t = 2$ expected cash flows at δ_1 not $\delta_1 E\delta_2$. Thus, the firm can compensate the bank at $t = 0$ with a lower expected return. Formally,

LEMMA **4** *: The expected rate of return on bank loans, $r_B(p)$, is lower if the secondary market is liquid.*

On the other hand, if there is a liquid secondary market, it is more difficult to make monitoring incentive compatible. This is because a bank can sell nonperforming loans at the pooling price. To mitigate this effect, the bank's stake in the time 2 payoff if the market is active has to be higher than if there is not an active market. Bank capital is more expensive than bond financing, and the former crowds out the latter, as the surplus pledgable to bondholders is reduced by this increase in expensive capital. Thus, the proportion of public debt is lower. Let $f_M(p) = \frac{M(p)}{I(p)}$ denote the fraction of the project funded by cheap public debt.

LEMMA **5** *: If the loan market is liquid for a name, then*

(i) The ratio of bank debt over total project size, $f_B(p)$, is higher.

(ii) The ratio of public debt over total project size, $f_M(p)$, is lower.

While the cost of bank capital $r_B(p)$ is lower, proportionally more has to be solicited per unit investment to ensure that the bank monitors when the loan is liquid. If the net effect is a reduction in the total surplus paid to the bank, $r_B(p)f_B(p)$, then investment, $I(p)$, increases. Conversely, if there is an increase in the total surplus accruing to the bank, then $I(p)$ decreases.

Our main result is that this reduction in investment caused by loan sales may occur for some parameter values. Thus, a liquid secondary market need not be efficient.

PROPOSITION **1** *: (i) A liquid secondary loan market exists if and only if the possible discount factor shock, δ, is sufficiently small so that $\delta \leq \frac{pq}{1-p+pq}$.*

(ii) A liquid secondary market is socially efficient if and only if the possible discount factor shock, δ, is sufficiently small so that $\delta \leq \frac{(1-q)(\delta_1-p)}{(1-p)-q(\delta_1-p)}$.

The first condition of Proposition 1 requires that for the market to be liquid, the pooling price, $r = \frac{pq}{1-p+pq}$, must be high enough that banks receiving discount factor shocks are willing to sell at this price.

Notice that for a fixed value of δ, an active market is ceteris paribus easier to sustain for higher rated names. Alternatively, for a fixed default probability, liquidity arises when the bank's private cost of bearing risks until maturity is greater than the liquidity premium in the loan market. Thus, we should expect to see more loans sold when banks are faced with a higher opportunity cost of lending (lower δ). This observation is the basis for our comparative statics results in Section IV. The second condition implies that for higher rated names, a secondary market is more likely to be ex ante inefficient.

The condition for efficiency is the threshold below which aggregate investment is larger when the loan is liquid. There are four possibilities in this economy.

<< Figure 3 about here >>

Figure 3 illustrates that there can be too much or too little loan trading. Financial institutions may inefficiently lay off low risk projects, leading to lower overall investment, or may inefficiently retain more risky projects when their opportunity cost is low.

PROPOSITION **2** *: If*

$$\frac{(1-q)(\delta_1 - p)}{(1-p) - q(\delta_1 - p)} < \delta \leq \frac{pq}{1-p+pq},$$

then the secondary loan market is liquid but this is inefficient.

For such parameter values, any commitment device preventing banks from actively managing their risks would be desirable ex ante. The intuition is as follows: In our model, loan sales are efficient if they reduce the total cost of loans. As we have shown, the expected return on bank loans always decreases with the advent of a liquid market, as banks no longer demand a liquidity premium. This effect is independent of the credit rating of the underlying name and only depends on the bank's opportunity cost of capital (δ). By contrast, as the credit quality of a firm increases, increasing amounts of bank loans have to be solicited with the advent of a liquid market. Loans to firms with high credit quality are very valuable in the secondary market and thus there is a proportionally larger benefit to shirking. For large enough p, the quantity effect outweighs the price effect and a liquid market is socially inefficient.[13]

IV. Cross-Sectional Implications

In our model, δ corresponds to the bank's opportunity cost of bearing a loan. Thus, a low δ corresponds to either profitable outside lending opportunities and tight financial constraints, or both. In the United States, the Reigle-Neal Act removed barriers to interstate banking in 1994. The Basel Capital rules requiring banks to maintain capital reserves of 7.25% of loans were adopted in 1989. The reserve requirement was increased to 8% in 1992. In 1991, the Federal Deposit Insurance Corporate Improvement Act (FDICIA) was passed. Among other provisions, this law mandated "risk-based" deposit insurance pricing. Subsequent to the Act's passage, banks with lower capital ratios paid higher premia. Thus, in contrast to the late 1980s; the early to middle 1990s were arguably a time when corporate lending became more constrained by legislation while new banking opportunities emerged. We interpret the late 1980s as a period when δ was high and the early to middle 1990s as a period when δ was low.[14] Consistent with this interpretation, in the late 1980s banks shifted their investment portfolios away from corporate loans and into government securities. Observers interpreted this as a response to the absence of capital requirements for government securities in the Basel I rules. Several empirical studies (surveyed in Gorton and Winton, (2002)) find some empirical support for the hypothesis that this regulatory arbitrage played a role in the "credit crunch" of the early 1990s.

We posit that the rise of loan liquidity was triggered by this change in δ, and consider changes in market aggregates that must also have occurred over the same period. Formally, consider a population of firms who differ only in credit ratings. Assume that their success probabilities, p, are distributed on $\left[\underline{p}, \overline{p}\right]$ according to $G(\cdot)$. We compare the cross-sectional

variations of firms' financial structure for two different values of δ, denoted $\underline{\delta}$ and $\overline{\delta}$, where

$$0 < \underline{\delta} < \overline{\delta} < 1.$$

Here, $\underline{\delta}$ is the opportunity cost of lending in the mid 1990s while $\overline{\delta}$ is that of the late 1980s. As an active corporate loan market emerged in the 1990s, we assume that the market is illiquid for $\overline{\delta}$, while for $\underline{\delta}$ there is a liquid loan market for all $p \geq p^*$, where $p^* \in \left[\underline{p}, \overline{p}\right]$. This situation is depicted in Figure 4.

<< Figure 4 about here >>

PROPOSITION **3** *: Suppose δ decreases from $\overline{\delta}$ to $\underline{\delta}$. Consider two firms that differ by their success probabilities $p'' > p'$, where $p'' \in [p^*, \overline{p}]$ and $p' < p^*$. Then, the yield spread between bank loans to each firm is larger for $\underline{\delta}$ than $\overline{\delta}$.*

If $\delta = \overline{\delta}$ the secondary market is illiquid, and the difference in yields between firms with ratings p' and p'', denoted $\overline{\Delta}$, is

$$\overline{\Delta} = \delta_1(p^{''} - p')(q\overline{\delta} + 1 - q).$$

If $\delta = \underline{\delta}$ liquidity arises for ratings above p^*, and the yield spread $\underline{\Delta}$ becomes

$$\underline{\Delta} = \delta_1(1 - p')(q\underline{\delta} + 1 - q) - \delta_1\left(1 - p^{''}\right),$$

and thus

$$\overline{\Delta} - \underline{\Delta} = -\delta_1 p' q\left(\overline{\delta} - \underline{\delta}\right) - \delta_1 p^{'}{}' q\left(1 - \overline{\delta}\right) < 0.$$

The first term on the right-hand side indicates that the yield has increased for the non-

traded name p' because of a decrease in δ. The second term corresponds to a smaller yield for the traded name because the liquidity premium vanishes.

Empirically, this implies that the bank loan pricing schedule is more sensitive to borrower credit quality in the late 1990s than the late 1980s. This observation can also be applied to the credit default swap market, the emergence of which has closely mirrored the market for loan sales. In the credit default swap market, banks buy insurance contracts against credit events. In our stylized model there is no difference between loan sales and credit default swaps as both allow the banks to release regulatory capital.[15] Thus, one interpretation of Proposition 3 is that the slope of bank loan yields as a function of the rating p should have steepened after the rise of credit derivatives, with no change in the distribution of credit losses. Schuermann (2004) finds some evidence in support of this phenomenon. He finds that an estimate of the slope for bank loan pricing schedules steepened during the 1990s, while its equivalent for bond pricing schedules flattened, if anything.

The proportion of bank financing in the economy should also have become more sensitive to credit rating.

PROPOSITION **4** *: Suppose δ decreases from $\overline{\delta}$ to $\underline{\delta}$. Then, the fraction of investments that is financed with bank loans becomes more sensitive to the credit rating of firms. Or, for $p' < p^* < p''$,*

$$f_B(p'', \overline{\delta}) - f_B(p', \overline{\delta}) < f_B(p'', \underline{\delta}) - f_B(p', \underline{\delta}).$$

In our model, for $p > p^*$, this fraction shifts from flat for $\overline{\delta}$ to increasing and convex for $\underline{\delta}$.

PROPOSITION **5** *: Suppose δ decreases from $\overline{\delta}$ to $\underline{\delta}$. Then, the fraction of investments*

that is financed with bonds decreases for any rating. Or,

$$f_M(p, \underline{\delta}) < f_M(p, \overline{\delta}) \qquad \forall p \in \left[\underline{p}, \overline{p}\right].$$

Note that in our model, the difference between loans and bonds is that loans are held by investors with monitoring skills (banks) while bonds are held by passive investors. In practice, not only banks, but other sophisticated investors who arguably have monitoring skills (institutional investors, hedge funds) have become increasingly active in the loan and private debt markets. Thus, empirical tests of Propositions 4 and 5 should compare the fraction of loans and debt that is privately placed with a small number of sophisticated investors with the fraction of publicly placed bonds.

V. Discussion and Conclusion

A. Trading Credit Derivatives as an Incentive Device

It is instructive to compare our results to those established in Kahn and Winton (1998) and Maug (1998). In a stock market context, they find that a long termist large investor may have higher ex ante incentives to monitor a firm when the market for the firm shares has a low informational efficiency. The intuition is that the large shareholder can buy shares in the market that are undervalued at an interim date because they do not fully reflect the impact of her high monitoring efforts on terminal cash flows. In our setting, this would correspond to a situation in which the bank could be incentivized by the prospect of *selling credit insurance* for the name that she has monitored at date 1. In our model, a bank which sells protection in the credit derivatives market reveals that it owns a good loan, and cannot profit from such a trade. This is because financially constrained banks would only buy

insurance protection in this model, and thus cannot be used to camouflage a sale of credit protection.

B. Pooling

As in Holmstrom and Tirole (1997), for tractability we abstract from the possibility that a bank finances projects that are not perfectly positively correlated. If the bank could finance diversifiable projects, we conjecture that the bank would find it optimal to sell senior claims backed by the whole pool of projects in the secondary market. A large financial contracting literature, pioneered by Diamond (1984), demonstrates the benefits from diversification under asymmetric information.

Interestingly, however, the secondary loan market does not seem to apply this rule of maximal diversification in practice. CLOs are often backed by fairly restricted pools, and are commonly specialized by country and/or industry. This presents a puzzle: the market for individual loans is rapidly growing, which contradicts the principle of maximal pooling. This suggests that diversification comes at a cost: potential investors may have different degrees of expertise in different asset pools. In this case, selling undiversified claims may increase the participation of sophisticated investors in the market for industries or names for which they have expertise. Such a trade-off between focus and diversification is alluded to by practitioners: Lucas, Goodman and Fabozzi (2006) note that "Investors should certainly be wary of deals in which very high diversity scores are achieved by managers straying from their fields of expertise."

C. Signalling

In Section III, we noted in passing that a bank owning a "good" loan that is also financially distressed cannot credibly signal its type in the secondary market. This is because the

owner of a worthless loan with limited liability would always mimic any contract that does not feature the possibility of negative future consumption in case of default on the loan.

Alternatively, assume that the banks owns other long-term assets that can be costlessly pledged to the buyer of the loan in order to "overcollateralize" the deal, or equivalently to credibly sell the loan with recourse. If the bank pledges a date 2 cash flow of at least $\frac{1}{\delta}$ for each unit of loan sold, then it is not mimicked by the owner of a bad loan.[16] In practice, overcollateralization is likely to be costly if the bank's counterparties have a lower valuation of the collateral than the bank itself. The cost of overcollateralization would then determine whether a good bank prefers signalling its type to selling the loan at a pooling price.

D. Perfect Learning

The assumption that the bank perfectly learns the date 2 outcome at date 1 is simplifying, but not innocuous. It implies that p measures both the *ex ante* riskiness of the project and the ex post informational advantage of the bank. Alternatively, suppose that the bank learns the date 2 outcome with probability $k \in (0, 1)$. We suggest that our results are robust under the assumption that higher-rated firms are more transparent, or high p implies low k. To see this, observe that there are now three types of banks trying to trade in the date 1 loan market:

(i) A bank who knows the loan is nonperforming;

(ii) A distressed bank who knows the loan is performing;

(iii) A distressed bank who does not have an informational advantage.

All such types would trade at the pooling price

$$r' = \frac{qp}{q + k\,(1-p)\,(1-q)}$$

if $r' > \delta$. Note that r' is increasing in p and decreasing in k. Thus, under the assumption that higher-rated firms are more transparent, so that the informational gap between banks and arm's length lenders is smaller for such firms, then distinguishing between k and p a lower k should reinforce the impact of a higher p on the price of protection for higher ratings. Similarly, inspection of the firm's profit in Lemma 3 shows that it is increasing in the loan spread, $1 - r$.

E. Basel II Capital Adequacy Rules:

In the cross-sectional analysis of Section IV, we studied the situation in which the same capital requirement applies to all corporate loans. Specifically, the discount factor had a constant value δ regardless of the credit rating p. This is in line with the Basel I rule imposing the same capital weight of 8% for all corporate borrowers.

Under Basel II, capital weights are supposed to increase with respect to the riskiness of loans. In our setting, the introduction of risk-based capital requirements corresponds to a situation in which the date 2 discount factor after a shock is no longer a constant, but is rather an increasing function of p, $\delta(p)$. It is easy to see that such a prudential reform has potentially positive effects in our setup, redirecting liquidity in the secondary market to where it is most desirable.

First, for high rated names, for which liquidity is ex ante inefficient, a sufficient reduction in capital requirements—namely, a sufficiently large increase in δ—will cause a desirable decrease in liquidity in the secondary market. Conversely, for lower-rated names that do not trade in the secondary market under Basel I, even though this would be ex ante desirable, a reduction in δ may spur financial innovation. In this case, a liquid market is desirable because the cost of additional incentives is lower than the benefits from flexibility.

We note that in our model, capital requirements are exogenous costs imposed on banks, and therefore on firms. It seems intuitive that, in the case of high-rated names, a reduction in these costs would be overall welfare improving. Perhaps more interesting is the result that, for high risk issuers, an increase in this exogenous cost imposed on the economy may actually be welfare improving, because this constraint spurs efficient liquidity. The intuition is that for sufficiently low-rated names, the negative impact of liquidity on ex ante incentives is limited because the market value of the risk, based on the *prior* probability of default, is low.

In sum, we have analyzed the recent rise of a secondary loan market with a simple model of endogenous liquidity. Banks trade actively when they find that selling a loan is preferable to bearing its risk. Their risks become liquid when the benefits from relaxing financial constraints overcome the informational cost of shedding risks. We posit that because banks' opportunity cost of carrying loans has increased, markets have evolved that allow banks to separate balance sheet management and borrower relationship management. Because liquidity implies ex ante inefficiencies, we predict possible excessive trading in high-rated paper, and insufficient liquidity in higher-yield tranches. Risk-based capital requirements for financial institutions should redeploy liquidity where it is the most desirable; namely, where the gains in financial flexibility overcome the costs associated with banks' reduced incentives to develop a long-term relationship with their borrowers.

Appendix: Proofs

Proof of Lemma 1: Recall that $\Delta(p) = \frac{(1-p)p(1-q)}{1-p(1-q)}$. Thus,

$$\frac{d\Delta(p)}{dp} = \frac{\left(1 - 2\,p + p^2\,\left(1-q\right)\right)\,\left(1-q\right)}{\left(1 + p\,\left(-1+q\right)\right)^2}.$$

Here, $\frac{\Delta(p)}{1-p} = \frac{p(1-q)}{1-p+pq}$. Clearly

$$\begin{aligned}
\frac{d\left(\frac{\Delta(p)}{1-p}\right)}{dp} &= \left(\frac{p\,\left(1-q\right)\,\left(1-q\right)}{\left(1-p+p\,q\right)^2}\right) + \frac{1-q}{1-p+p\,q} \geq 0 \\
\frac{d^2\left(\frac{\Delta(p)}{1-p}\right)}{(dp)^2} &= \frac{2\,p\,\left(1-q\right)\,\left(1-q\right)^2}{\left(1-p+p\,q\right)^3} + \frac{2\,\left(1-q\right)\,\left(1-q\right)}{\left(1-p+p\,q\right)^2} \geq 0.
\end{aligned}$$

■

Proof of Lemma 2, 3: For each of these cases, all the constraints are binding. The stated results follow. ■

Proof of Lemma 4: The promised return per dollar invested is $\frac{pR_BI}{L}$. Thus, if there is a liquid secondary market, this is $\frac{pR_BI}{L} = \frac{1}{\delta_1}$. If not, then $\frac{pR_BI}{L} = \frac{1}{E\delta_2\delta_1}$.

The result follows from $E\delta_2 < 1$. ■

Proof of Lemma 5:

(i) The ratio of bank debt over total project size if there is an active loan market is

$$\frac{L^{Liq}}{I^{Liq}} = \frac{pB_B}{p-r},$$

and if there is not,

$$\frac{L^{no}}{I^{no}} = B_B.$$

Thus, $\frac{L^{Liq}}{I^{Liq}} \geq \frac{L^{no}}{I^{no}}$ if $p \geq p - r$, which always holds.

(ii) The ratio of market debt over total project size, if there is no active market is

$$\frac{M^{no}}{I^{no}} = pR - b_F - B_B \frac{1}{\delta_1 E\delta_2},$$

and if there is one,

$$\frac{M^{Liq}}{I^{Liq}} = pR - b_F - B_B \frac{p}{\delta_1 (p-r)}.$$

Then, $\frac{M^{no}}{I^{no}} \geq \frac{M^{Liq}}{I^{Liq}}$ if $E\delta_2 > \frac{p-r}{p}$, which always holds. ■

Proof of Proposition 1:

(i) A bank will sell the loan on a failed project at any price $r \geq 0$. A bank with a successful project values it at $\delta_2 R$, and thus will sell it if $rR \geq \delta_2 R$, or $r \geq \delta_2$. If $r < \delta$, then only the banks who know that the project is unsuccessful will sell, thus claims are worth zero. If $r \geq \delta_2$, then with probability $1-p$ the bank knows the project is a failure, and with probability pq, the project was a success, but the bank got a shock. Thus, if $r \geq \delta_2$, the expected value of \$1 promised at date 2 is $\frac{pq+(1-p)0}{pq+(1-p)}$.

(ii) Follows immediately from

$$I = A \left(\begin{array}{ll} \frac{1}{1-pR+b_F+B_B \frac{1-\delta_1 E\delta_2}{\delta_1 E\delta_2}} & \text{if the market is liquid} \\ \frac{1}{1-pR+b_F+B_B \frac{p}{p-r} \frac{1-\delta_1}{\delta_1}} & \text{if not.} \end{array} \right.$$

■

Proof of Proposition 2: This is a straightforward consequence of Proposition 1. ■

Proof of Proposition 3: If $\delta = \bar{\delta}$, there is no market and thus the difference in yields between a firm with p' and p'' denoted $\overline{\Delta}$ is

$$\overline{\Delta} = \delta_1 (p'' - p')(q\bar{\delta} + 1 - q).$$

If $\delta = \underline{\delta}$ a liquid market arises for ratings above p^*, and the yield spread $\underline{\Delta}$ is

$$\underline{\Delta} = \delta_1(1-p')(q\underline{\delta} + 1 - q) - \delta_1\left(1 - p''\right),$$

and thus

$$\overline{\Delta} - \underline{\Delta} = -\delta_1 p' q\left(\bar{\delta} - \underline{\delta}\right) - \delta_1 p'' q\left(1 - \bar{\delta}\right) < 0.$$

■

Proof of Proposition 4: From Proof of Lemma 5, the ratio of bank debt over total project size if there is an active market is

$$\frac{L^{Liq}}{I^{Liq}} = \frac{pB_B}{p-r},$$

and if there is not,

$$\frac{L^{no}}{I^{no}} = B_B.$$

■

Proof of Proposition 5: From Proof of Lemma 5, the ratio of market debt over total project size if there is no secondary loan market is

$$\frac{M^{no}}{I^{no}} = pR - b_F - B_B\frac{1}{\delta_1 E\delta_2},$$

and if there is one,

$$\frac{M^{Liq}}{I^{Liq}} = pR - b_F - B_B\frac{p}{\delta_1(p-r)}.$$

■

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Notes

[1]This is reported in Lucas, Goodman and Fabozzi (2006).

[2]This figure is reported in Drucker and Puri (2006).

[3]This assumption follows Breton (2003).

[4]See *The Economist*, "Pass the Parcel", Jan. 16, 2003.

[5]Specifically, we assume that all contractible payments are bounded below by a finite amount that we normalize to zero.

[6]DeMarzo (2005) represents a recent contribution.

[7]Alternatively, one could model the bank as incurring a private monitoring cost. The current formulation is the simplest one that ensures all constraints bind at the optimum.

[8]We assume that the realization of bank's discount factor at $t = 1$ takes on two possible values for simplicity. The qualitative results go through if the bank's outside opportunities are drawn from a known continuous distribution.

[9]That the bank has all the bargaining power at time 1 simplifies the derivation of the optimal contracts, but is not crucial to our results. The key driver of the results is that the bank acquires proprietary information through monitoring.

[10]A typical solvency ratio requires that 8% of the weighted sum of assets be less than the book value of equity.

[11]We explore this idea further in Section V.

[12]We note in passing that a trivial zero trade equilibrium can also be constructed by assigning the arbitrary off-equilibrium path belief to the bond market that banks with a discount factor shock do not trade. In such an equilibrium the price is also zero.

[13]We conjecture that in a dynamic model with reputation effects, higher-rated firms may

require less monitoring.

[14]We focus on a decrease in δ to simplify the analysis. An increase in q yields similar results.

[15]Under such an interpretation the secondary market loan spread in our model corresponds to the price of protection in the CDS market.

[16]The (distressed) owner of a bad loan would receive \$1 from the loan sale, and lose the collateral at date 2, which has a present cost of \$1 at date 1.

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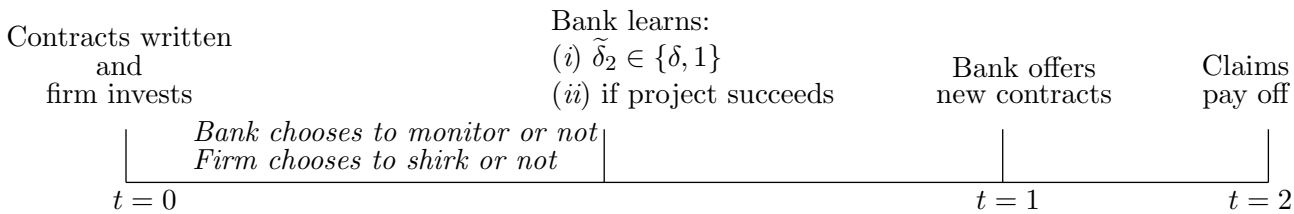

Figure 1. Sequence of events.

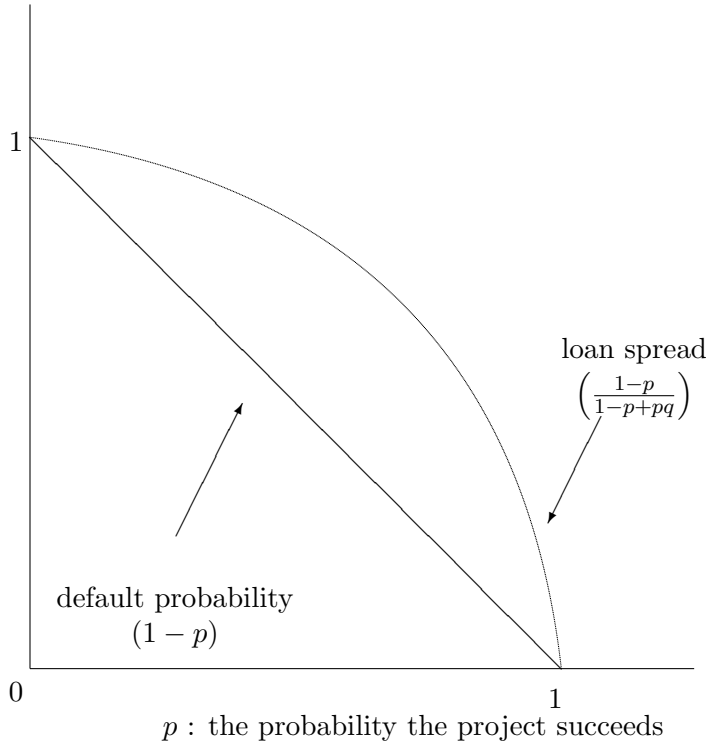

Figure 2. The loan spread and default probabilities: The figure illustrates the loan spread and the default probability as a function of p, the probability that the project succeeds. The loan spread is always greater than the default probability.

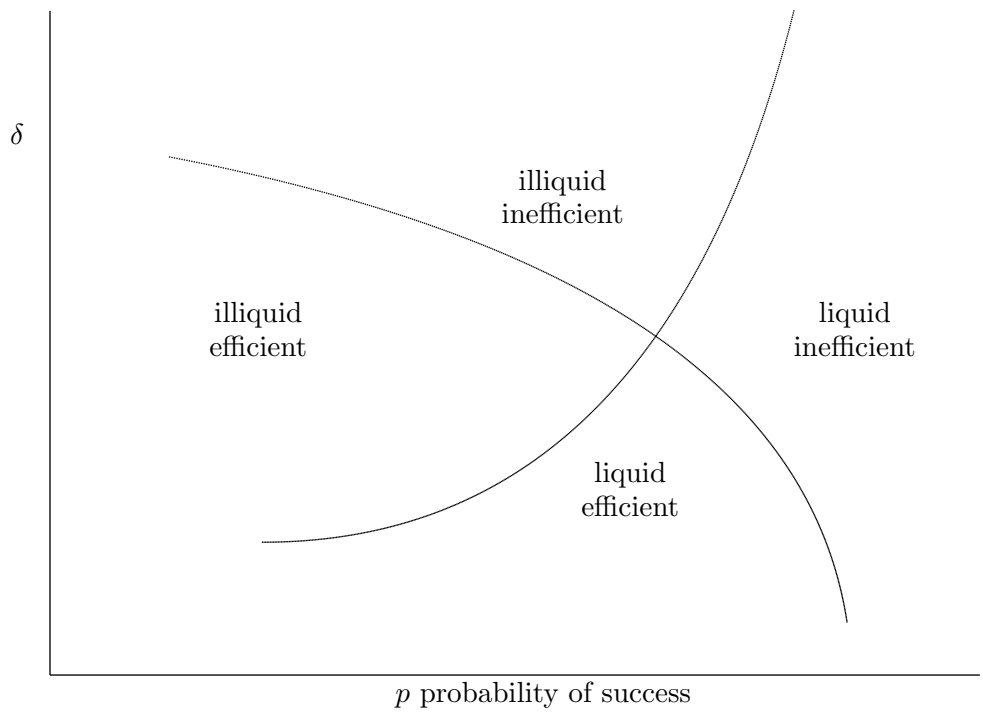

Figure 3. Efficiency and Liquidity: Four different combinations of efficiency and liquidity may exist in an economy. If p, the probability of success is sufficiently high then the loan markets are liquid; if the bank's opportunity cost of capital is sufficiently high (δ sufficiently low) then financial innovation is efficient.

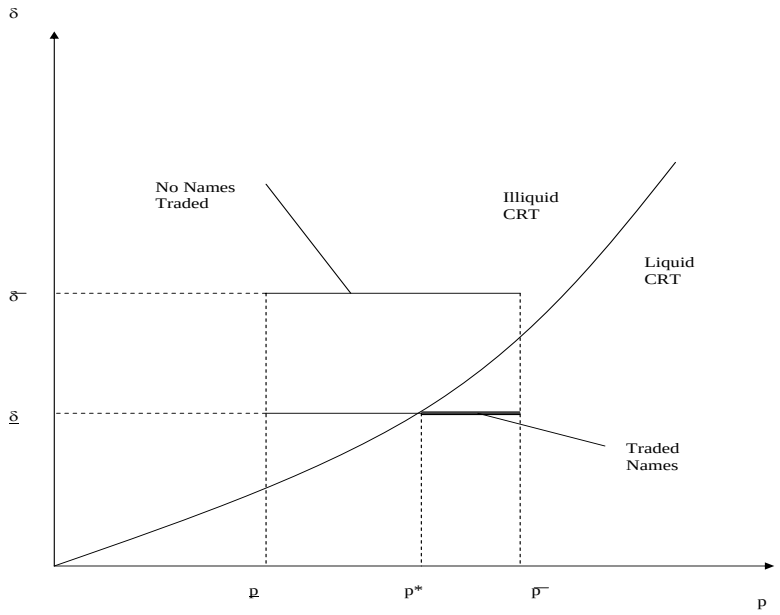

Figure 4. Change in bank cost of capital from $\bar{\delta}$ in the late 1980s to $\underline{\delta}$ in the early 1990s: In the early 1980s, banks' opportunity cost of capital was low (δ was high). After regulatory changes, the opportunity cost of capital increased (δ fell) and financial innovation allowed banks to trade credit risk (Credit Risk Transfer market was liquid) on highly rated names (i.e., for $p > p^*$).