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Default Risk, Liquidity and Loan Commitments

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LOAN COMMITMENTS

by

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Pricing Loan Commitments

In this paper, we discuss some characteristics of loan commitments and how those characteristics affect the value of a commitment. We use the general term loan commitment to describe a variety of agreements between banks and their borrowers. The feature that distinguishes loan commitments from other bank lending activities is that commitments include an explicit right for the borrower to take out a loan with the bank at some future date. The interested reader should see Crane (1973), Higgins (1972), and Summers (1975) for more complete descriptions of these financial agreements.

Authors such as Bartter and Rendleman (1978, 1979), Hawkins (1982), Thakor, Hong, and Greenbaum (1981) and Pyle and Skelton (1981) have identified loan commitments with put options and have attempted to use aspects of the theory of asset valuation under diffusion rate processes to price them. In these models the firm purchases the right to sell its debt to the bank at some prespecified interest rate or rate spread. The firm gains when the fair rate of interest for its debt is above the prespecified rate of interest by selling its debt to the bank at a "higher-than-fair" price. Most authors assume that the source of the variation in this "fair" interest rate for the firm is changes in its default risk. In order to place this work in context we outline some important characteristics of loan commitments below.

1.3 Loan Maturity

The loan made by the bank under a loan commitment will have a maximum maturity that is specified by the terms of the commitment. Bartter and Rendleman (1979) consider a commitment that would allow the borrower to take down a one-year loan at any time during the commitment period. In practice, the usual arrangement is for the ending date of any loan made by the bank under the agreement to be no later than the last day of the commitment period.

1.4 Loan Rate

Most loan commitments are written on variable rate loans. Such commitments have specified loan rates at fixed spreads above one or more index rates with different frequencies of adjustment for the index. For example, a recent agreement specifies that, during a given commitment period, the
borrower may take down a domestic loan at \( \frac{1}{2} \) of 1 percent plus the bank's prime rate "from time to time in effect" or a euro-dollar loan with one, three, six, nine, or twelve months to maturity at 3/4 of 1 percent plus LIBOR (the London Interbank Rate) on an interbank loan of the same maturity. One can think of the LIBOR alternative as involving an objective, discretely adjustable index as compared to the more subjective (bank specific) and more continuously adjustable prime rate.\(^1\) Where the borrower can choose among indexes at the time of takedown, as is the case for the agreement just mentioned, there is an interesting option generated that to our knowledge has not been studied.

The value of a variable-rate loan commitment viewed as a "pure" option depends on the variability of the loan rate under the commitment relative to the market rate for a loan to the firm. An index rate that is imperfectly correlated with the market rate can produce value for a variable rate commitment. Perhaps more importantly, variable rate commitments usually include a fixed spread (or schedule of spreads) above the index rate. Bartter and Rendleman (1979) argue that the option to borrow at a fixed spread (given a perfectly correlated index rate) will only have value "...if the terms of the commitment expose the bank to changes in customer credit risk." As noted below, it may be that the terms of commitments leave room for this effect. A related source of value that is even less likely to be constrained by the terms of commitments would result if changes in the market price of risk led to changes in the market premium on the firm's debt relative to the index rate. Even without the risk of default, the market rate of interest on the loan may include a liquidity premium above the index rate and that liquidity premium need not remain constant over time.

Loan commitments may also be written with fixed loan rates. This is a polar case of the fixed-spread commitment in which there is no adjustment to the index rate over the commitment period. Fixed-rate commitments provide full hedging against changes in the market interest rate on the firm's loans up to whatever limits are set by the covenants and conditions discussed below.

The Bartter and Rendleman (1979) study considers fixed rate commitments. Thakor, Hong and Greenbaum (1981) and Hawkins (1982) consider fixed spread commitments, the type we consider later in this study. Campbell (1977) considers both types in an expected utility framework.
1.5 **Covenants and Conditions**

Commitment agreements may include affirmative and negative covenants similar to those found in other debt contracts. In addition, these agreements typically include what has been called a "general nervous clause" stating that the bank is not required to extend credit if a "material adverse change" has occurred with respect to the borrower. A material adverse change has been defined as any occurrence of any nature that will materially adversely affect the financial condition or operations of the borrower or impair its ability to meet its obligations under the agreement. These covenants and conditions are clearly intended to limit the extent to which the default-risk premium on the firm's debt can increase. It is not clear, however, the extent to which these constraints and financial tests can fully protect the bank against changes in the riskiness of that debt or from changes in the market price of risk.

1.6 **Termination Conditions**

The conditions under which the borrower or the lender may terminate all or part of the credit commitment are specified in the agreement. These conditions may include costs to either party. For example, the agreement may specify that the bank may terminate its obligation to make loans under the commitment in any case of default, such as the violation of a covenant, without foregoing the right to be paid the commitment fee. The agreement also typically specifies that the borrower is permitted to reduce or completely eliminate the credit commitment amount and thereby reduce or eliminate additional commitment fees. A typical clause to this effect is: "The Borrower may, at any time on at least five Business Days' prior notice ..., reduce the Total Credit Commitment Amount permanently in an integral multiple of $7,000,000." Since fees in this case are based on the excess of the Total Credit Commitment Amount over the outstanding principal amount of all Credit Notes, a reduction in the Total Credit Commitment Amount results in a reduction in subsequent fee payments.

1.7 **Commitment Fees**

An important characteristic of most, if not all, loan commitments is that they are paid for by a fee (explicit or implicit) that depends on the size of
the unborrowed commitment amount and the length of time this amount is unborrowed. For example, a typical fee is \( \frac{1}{4} \) of one percent per annum on the unborrowed balance. The fee is accrued continuously and paid periodically (e.g. quarterly) until the termination of the commitment. This, as noted above, may occur at any time at the option of the borrower, in the typical agreement.

1.8 Homemade Loan Commitments

Pyle and Skelton (1981) note that firms are able to create positions equivalent to the loan commitments we have described. If the borrower can obtain a prepayable, variable-rate term loan based on the same index as the commitment, the firm can borrow at the term loan rate and re lend at the index rate until the loan is needed. When funds are needed or when the loan commitment is no longer needed, the firm can take back its loan to the bank and use the proceeds to meet its loan demand or to pay off the term loan.

The opportunity to create homemade loan commitments will put an upper limit on what a firm would pay for a negotiated loan commitment. Similarly, because banks are on the opposite side of the homemade commitment transactions, the value of the homemade scheme to the bank will place a lower limit on the price banks would charge for a variable rate commitment.

As a final point, consider these homemade commitments in the context of the normal financing of the firm. When the firm issues debt, it invariably reinvests the proceeds. And if the firm needs funds, it is normally possible to sell some of the assets of the firm. Thus, debt financing automatically creates a loan commitment of sorts. The important difference between bank-provided loan commitments and the commitments implicit in debt financing seems to be only that the bank-provided commitment provides a more liquid source of funds than the implicit commitment.

A Critical Look at Option Pricing Approaches

We refer above to previous work (including our own) which treats loan commitments as put options; that is, the firm purchases an option to sell its debt to the bank at some prespecified price. The firm gains when the "fair" rate of interest for its debt is above the contracted rate of interest
because the "fair" price for its debt is thus lower than the prespecified price. The source of these differences in interest rates and prices is the changing default risk of the firm.

We argue below that the value of this default-risk option as modelled in earlier work is small. We do so for reasons related to the necessary conditions for these options to have their predicted value. For the default-risk option to be valuable it must be an enforceable contract, the parties to the contract must behave as the valuation model predicts, and markets must be "reasonably" frictionless. We find all three of these conditions are violated.

2.1 Cancellation and Fee Structure

As we discuss above, the fees for loan commitments are paid as a percentage of unborrowed funds. These fees are paid continuously over the life of the contract. Thus, when a loan commitment is made, no money changes hands: The bank agrees to lend, when called upon, and the firm agrees to begin paying fees.

In addition, we point out that in most cases the commitment may be cancellable by either party with few important consequences. The bank may refuse to lend when the firm has experienced a "material adverse change" in its financial well being, and the firm may reduce or completely eliminate the funds committed to it with an accompanying reduction in fee. Alternatively the firm and the bank may simply renegotiate the terms of the loan commitment simultaneously cancelling one commitment and entering into another. A contract of this type can have only a small value as a default-risk option. When the firm and the bank enter into the loan commitment, the present value of the fee is exactly equal to the value of the commitment. Both the bank and the firm are in a net-zero-value position. Now suppose the default risk of the firm changes relative to the index. One of the two parties will immediately be in a net-positive position, and the other will be in a net-negative position. If cancellation is easy and costless, the party in the net-negative position will cancel. If cancellation involves some costs, the party in the net-negative position will wait for the cost of the position to exceed the cost of cancellation. In any case the ability of the parties to cancel the contract (even with small penalties) will cause the option value of such loan commitments to be small relative to those which
are not cancellable.

There is a careful analysis of the value of a non-cancellable, variable rate loan commitment in Hawkins (1982). He shows that the periodic payments by the firm to the bank can be written as an unavoidable fixed fee and a variable cost component that is positive when the firm is borrowing. The firm buys a complex option on a variable rate loan with a fixed spread and pays for this option by issuing an interest-only bond with coupons of a fixed size. It is not clear why the option would be purchased this way rather than by paying a lump sum at the onset of the commitment period. The latter approach would avoid the unnecessary complication of valuing the potentially defaultable interest-only bond. In short, in the typical option contract, the buyer pays a known price today in exchange for the option.

If loan commitments are options on the default premium on a loan, why are they paid for with an interest-only bond that may be difficult to value when simplicity would argue for a lump sum payment? To our knowledge none of the previously mentioned studies provides an answer to this question.

Suppose the loan commitment can be cancelled. We shall consider the case of no cancellation costs and a minimum cancellation notice period. For a firm value of \( V_0 \), let the market value of the loan commitment at \( t_0 \) (when the agreement begins) be \( F_0(V_0, t_0) \). Let \( L \) be the amount of unborrowed funds, and let \( f \) be the daily fee per dollar of unborrowed funds. Then \( f*L \) is the daily fee paid to the bank at \( t_1 \) \((=t_0+\Delta t)\) and \( \Delta t \) is the number of days in the cancellation period. For the firm to enter into the agreement at \( t_0 \) we must have

\[
pv_0[F_1(V_1, t_1) - f*L*\Delta t] \geq 0.
\]

For the bank to agree to provide the commitment, this inequality must hold in the opposite direction. Assuming "fair market pricing," these two inequalities imply that the current value for the loan commitment must be equal to the present value of the fees paid during the first cancellation period

\[
(1) \quad F_0 = pv_0[F_1] = pv_0[f*L*\Delta t]
\]

For a given \( f \) and for \( \Delta t \) small (say 3-5 days), this value is clearly small
relative to the value of a non-cancellable loan commitment with the same proportional fee, \( f \) (it is of the order \( \Delta t/T \) where \( T \) is the number of days in the commitment period).

Assume that both parties may cancel at \( t_1 \). The decision problem facing the firm may be written as

\[
(2) \quad F_1 = \max\{0, pV_1[(F_2 | V_1) - f*L*\Delta t]\}
\]

where \( F_2 | V_1 \) is the conditional value of the commitment at \( t_2 \) given the realized firm value at \( t_1 \).

If the bank is also free to cancel, the bank will minimize the same function and it must be the case that \( F_1 = 0 \) for all \( V_1 \). Therefore, the bank cannot charge a positive fee for a mutually-cancellable loan commitment. Certain "letter commitments" seem to conform to this case.

The basis for a cancellation of a formal loan commitment by the bank is the material adverse change clause. It is not clear that this clause provides a basis for cancellation in every situation in which the present value term in (2) is positive. For example, a bank might find it difficult to impose the covenant if the cause of the bank's net-negative position was an increase in the market price of default-risk rather than an increase in the default-risk of the borrower. However, as long as there are potential changes in the firm's value that will trigger the use of the material adverse change clause, this covenant reduces the value of a commitment as a default-risk option and introduces uncertainty into the terms of the contract. To our knowledge, the problem of valuing the default-risk option given potential cancellation by the bank has not been analyzed.\(^3\) Furthermore, uncertainty regarding the firm value at which cancellation would occur is inconsistent with the options methodology that has been used to value loan commitments. Furthermore, it is not clear why a firm would accept this uncertainty on a loan commitment that was being used as a hedge against adverse changes in default-risk. Again, this does not seem to have been explained in the earlier studies.\(^4\)
The vagueness of the material adverse change clause suggests that the bank may not be free to cancel after t₀. Suppose that the bank is stuck with the contract but the firm can cancel with Δt days notice. From (2) it is clear that F₀ will be the present value of a set of non-negative numbers. From (1) it is clear that the maximum size of these numbers will be bounded by f*kl*Δt. This places limits on the kinds of loan commitment agreements that banks will be willing to write. It tends to rule out commitments that permit significantly adverse changes in default-risk even if they have a small likelihood of occurring and also to rule out smaller adverse changes that are likely to persist over substantial fractions of the commitment period. These limits can be achieved, that is to say the default-risk option value of a cancellable loan commitment can be rendered unimportant, by setting the commitment spread sufficiently above the firm's current default premium to discourage takedowns on small adverse changes in the premium and by introducing the material adverse change clause so the bank can cancel given significantly adverse changes. These seem to be the characteristics of actual loan commitments and they are consistent with our view that there is little value to such commitments as default-risk options.

2.2. Partial Takedowns

The option pricing approach predicts that when the fair rate of interest on the firm's debt exceeds the index rate plus the fixed spread, the firm will borrow the full amount of the committed funds. In practice, however, firms frequently borrow only fractional amounts. Thus the "option" to borrow at the contracted rate is often partially exercised. Its value must therefore be less than one that is always fully exercised.

2.3 Arbitrage and Perfect Markets

An assumption critical to the option pricing approach is perfect, frictionless capital markets. That is, for the option to have value, it must be possible to profit from transactions involving it. (Of course, in a perfect, frictionless market for financial claims there is little need for financial intermediaries and therefore little reason for the existence of banks). The option pricing approach assumes that funds borrowed under the loan commitment (at an advantageous rate) are easily reinvested in some project of the firm or in some fairly-priced financial asset.
In a perfect market for physical capital the firm uses the borrowed funds to expand by purchasing more plant and equipment. It exploits the gain from borrowing at a favorable rate to finance projects that would otherwise be rejected. In a perfect market for financial capital the firm uses the borrowed funds to purchase the shares of other firms or to repurchase its own shares.

Such transactions, however, do not take place without substantial costs. The "additional" project to be undertaken by the firm may cost (in terms of net present value) more than the gain from favorable financing. Likewise, the transaction costs for a large purchase of securities may exceed the gain from favorable financing. It would seem, therefore, that unless there are large gains from loan commitment financing the firm does not and should not perform the arbitrage prescribed by the option pricing approach; and for cancellable commitments such large gains seem to be precluded.

An Alternative Approach

Our analysis of the default-risk option approach to loan commitment valuation and our conversations with those who borrow and lend under loan commitments convince us that the important element of value in these contracts is the liquidity they supply to firms. Our alternative views on the determinants of loan commitment value exploit the familiar model of liquidity management derived by Miller and Orr (1966).

3.1 What is Liquidity?

We define a liquid asset as one which can be sold at a price which is invariant to the time period of the sale. For the purposes of this paper, we call the class of assets which meets this requirement "Treasury bills." If capital markets are perfect and frictionless all assets are completely liquid, and, therefore, liquidity can have no relative merit. If physical and financial assets do not trade frictionlessly, "T-bills" will sell at a premium in price to other assets (risk adjusted).

3.2 The Demand for Liquid Assets

In a world in which financial markets are neither perfect nor frictionless, firms will demand liquid assets. This demand arises from the neces-
sity to meet unexpected requirements for working cash and to capitalize on unexpected investment opportunities. Miller and Orr (1966) derive a model of the demand for cash by firms in a simple setting where cash flows follow a driftless random walk. The firm manages its cash balances by moving funds from earning assets to cash when the cash balance is too low and by doing the reverse when the cash balance is too high. The lower limit on the cash balance is assumed to be zero. The upper limit and the point to which the cash balance is returned are derived as functions of the opportunity cost of holding cash, the cost of transacting in the earning asset and the variance of the firm's cash flows.

The average cash balance optimally held by firms in the Miller-Orr model is

\[ M^* = \frac{4}{3} \left(3\gamma \sigma^2 / 4\nu\right)^{1/3} \]  

(3)

where \( \gamma \) is the cost of transacting in the earning asset, \( \nu \) is the opportunity cost of holding cash and \( \sigma^2 \) is the variance of cash flows to the firm.

If all firms are assumed to face the same opportunity and transaction costs, the cash balances held by them will differ only because the variance of their cash flows differs. Likewise, the cost of maintaining the prescribed average cash balance will be lower for low-variance firms than for high-variance firms. This is because the opportunity costs for small balances are smaller and because low variance firms transact less frequently.

The expected costs in the Miller-Orr model are

\[ E(c) = [\sigma^2]^{1/3} \left[0.606\gamma(\gamma/\nu)^{2/3} + 1.21\nu(\gamma/\nu)^{1/3}\right] \]  

(4)

This model is, of course, a model of the demand by firms for a particular liquid asset—cash. It is a simple matter to adapt this model to the demand for other liquid assets. If we assume that cash balances can be maintained at zero and Treasury bills sell at a premium because they are very liquid, \( \nu \) (the opportunity cost of funds) becomes the difference between the return paid on Treasury bills and the return paid on less-liquid assets such as other securities or physical capital (risk adjusted). The firm's demand for Treasury bills is derived in the same manner as
Miller and Orr derive the demand for cash, and the demand for liquidity in the form of Treasury bills is thus related to the variance of the firm's short-term capital requirements.

3.2 Loan Commitments and Liquidity

A particular firm's holdings of Treasury bills may be financed in the same manner as any other asset of the firm. The firm may issue debt and invest the proceeds in Treasury bills. As we note above, this procedure produces the equivalent of a loan commitment.

But suppose we introduce a second firm, identical to the first, except that the short-term capital requirements of the two firms are not perfectly correlated. From Equation 4 it is apparent that the two firms will be better off by combining their holdings of T-bills. That is, because their short-term capital needs are not perfectly correlated, the variance of the combined needs will be less than twice the variance of the individual needs.

The average balance of Treasury bills (Equation 3) for the combination will be less than twice the individual balance. And the cost per-firm of maintaining the combined balance will be less than the cost of maintaining an individual balance. If more firms with less-than-perfectly-correlated capital demands can be induced to join this enterprise the cost per-firm can be further reduced.

Now suppose a bank offers a convenient way of combining the liquid balances of many firms. The bank agrees to lend funds to a number of firms for the purpose of purchasing liquidity in the form of special CD's which the bank promises to redeem on demand. In order to guarantee the liquidity of its CD's the bank manages a portfolio of T-bills. When called upon, the bank sells part of the portfolio and delivers the proceeds to the firm redeeming the CD's it holds. The bank also receives funds by selling CD's to firms with extra cash. At any time the net cost to a particular firm for liquidity is the difference between its borrowing rate from the bank and the rate paid by the bank on its redeemable CD's. This rate differential exists because the bank's CD's are more liquid than the debt of the firm; that is, the bank passes along the cost of holding T-bills to assure the liquidity of its obligations.

But this is a cumbersome arrangement involving two separate transactions, borrowing from the bank and investing in redeemable CD's. If the
bank decides to combine the two into a single arrangement, the result is simply a loan commitment. A firm pays a fee based on the amount of available credit (the unredeemed CD's). When a firm takes down part of the commitment, the fee is reduced. The firm redeems the CD's and uses the proceeds to invest in some less-liquid asset, thereby avoiding the cost of investing in liquid assets.

Because the bank serves many firms, the T-bill portfolio it holds to ensure that it can deliver on its loan commitments is small, and therefore the fees it charges to firms are low. If the bank is able to transact at a lower cost than individual firms, further economies may be achieved. The linkage of banks through inter-bank markets such as the Federal Funds market in the U.S. allows banks to manage their liquidity more efficiently and is the source of one such economy. For these reasons bank-provided loan commitments dominate homemade loan commitments.

3.3 **Liquidity and Criticisms of the Default-Risk Approach**

We criticize the default-risk option approach to loan commitment valuation for three reasons. First, the standard terms of loan commitments work to ensure a small default-risk option value for cancellable commitments. Second, market frictions are inconsistent with the arbitrage that is necessary for the default-risk option to have even the small value suggested by the option approach. Third, firms frequently borrow less than the full amount of the commitment.

While these observations are inconsistent with the default-risk option approach to valuing loan commitments, they are entirely consistent with our alternative explanation. An arrangement between banks and firms to provide access to liquid funds must necessarily abstract from default risk. The standard terms of loan commitment agreements, easy cancellation by the borrower, commitment spreads that are above market spreads, and the material adverse change clause, all tend to limit the value of the loan commitment as a default-risk option and thus to allow both parties to the agreement to abstract from default risk.

The fact that markets are neither perfect nor frictionless is contrary to the assumptions in the default-risk option approach. It is a motivation for the liquidity approach. If all markets are perfect and frictionless, liquidity has no value. Because markets are not perfect and frictionless,
firms demand liquidity in the form of loan commitments.

Partial takedowns are also contrary to the assumptions in the default-risk option approach. They are a prediction of the liquidity approach. If firms use loan commitments to meet demands for random short-term capital needs, they will take down the commitments only as needed.

3.4 Implications for Pricing

We argue that loan commitments arise from the pooling of the liquidity balances of firms. The diversification of short-term capital requirements across many firms allows banks to offer liquidity at an attractive price. Because this price is related to the degree of diversification, the fee charged by the bank for a particular loan commitment will be related to (1) the size of the commitment, and (2) the correlation of the short-term capital needs of the firm with the other firms served by the bank.

An interesting implication of our model is that in providing loan commitments, banks enjoy economies of scale. That is, with more firms served, the greater is the diversification and the lower is the fee. In the limit, with one large bank serving all firms and individuals, the cost of liquidity is zero.

Conclusions

Our close look at loan commitments convinces us that the important element of value for these contracts is the guarantee of liquidity rather than the default-risk option. If firms demand liquid assets, they will contract with intermediaries who pool the liquidity needs of many firms and, therefore, supply liquidity at an attractive price relative to the costs of firms acting alone. What remains is to develop a more explicit model of loan commitment pricing based on these notions. This model will also have implications for the scale of banking and for the demand for liquid assets.
1. Here we are speaking of the frequency of adjustment after the loan is taken down.

2. The option is complex because during the commitment period the firm can put a loan to the bank and can call that loan without losing the right to put it again later in the period.

3. The option to cancel the loan given a material adverse change takes at least one of three forms. The lender has the right to refuse to make additional loans under the commitment. In many cases, the lender may also have the right to declare outstanding loans due and payable. Under a third alternative, the lender can require collateralization of outstanding loans. Each of these alternatives should effect the valuation of a default-risk option.

4. Hawkins (1982) suggests that uncertainty associated with the material adverse change clause is there to prevent the use of loan commitments as loan guarantees. This allows him to sustain the assumption of no outside borrowing in a fixed investment model of commitment value. However, he does not incorporate the full effect of the loan cancellation option on either of his models.
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