Incorporating New Fixed Income Approaches Into Commercial Loan Valuation

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Accurate loan pricing has never been more complex than it is today and it has never been more critical to price accurately. This article discusses differences between some traditional and more sophisticated methodologies.

Competition in the commercial loan market has increased dramatically over the last decade. This is true for several reasons:

- There is more capital in the industry than can be put to good purpose; therefore, banks have been bidding down existing deals and compressing margins.
- Institutions from other parts of the financial sector have offered product innovations and product alternatives—such as private placement as direct competitors to the standard loan product—that cause additional pressure on spreads in the marketplace.
- Credit spreads are exceedingly tight in the current market. As a result of recent contraction in the credit spreads across all credit ratings, individual banks now face a pricing grid with an unprecedented and unreasonable compensation for the risk borne.
- Competitors and customers have learned more about the value of structure. As a result, banks have been suffering from inappropriate pricing of the embedded options built into their loan products.

The net result is that many bankers are building loan portfolios that may not cover their true costs, that is, the cost of funding, the level of the risk, and the nature of the embedded options contained in the loan contract. To remedy this situation, the banking industry must directly address the issue of appropriate and accurate loan pricing. This is particularly true in the large corporates area, where this problem is most serious for two reasons:

1. It is a highly contested market in which the investment banking and insurance sectors are vying for top-rated customers.
2. With excess of capital in the industry, the large corporates market has been seen as a place to employ large quantities with little cost; however, such competition has led to more pronounced tight spreads.

The appropriate and prudent action for senior credit officers in reaction to this situation is to tighten the standards before it is too late. In essence, senior management must invest in *better credit analysis* and insist on acceptable credit spreads as competition increases. However, this can only be accomplished by improving the bank's capability to *price accurately* and by enforcing required minimum spreads on loan deals. As always, this is easier said than done—accurate loan pricing has always been a difficult process. Banks have insufficient knowledge of the underlying cash flows embedded in their individual

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loans and aggregate loan portfolio. In addition, banks tend to give away options without realizing their true value to the borrower or the true cost to the bank placing the loan into its portfolio. To rectify this problem, it is necessary that the banking industry learn from developments in the bond market and apply the advances that have occurred there to the key issue of appropriate loan pricing. Recently, the bond market has revolutionized the way in which it looks at the pricing of credit risk. Much can be gained by applying the approach currently employed there to the current context of accurate loan pricing.

Incorporating Bond Models into the Loan Market

The traditional approach to bond valuation has been to link the required credit spread of an issue to its ratings supplied through Moody's or Standard & Poor's standard analysis. In turn, Moody's and S&P assign a risk rating that is related to the probability of default over the foreseeable future. The net result is that a rated issue acquires an initial spread that is directly related to market demand for yield in the seasoned bond market.

This approach to default probability and pricing is static, rather than dynamic. Recent work by Asarnow, Jarrow and Tumbull, and a number of other fixed-income researchers has illustrated that it is necessary to look more closely at the dynamics of the credit risk embedded into a fixed-income instrument to adequately incorporate default probabilities in pricing an instrument. The evolution of bond risk rating is carefully studied through the use of migration analysis. Migration analysis derives from a recognition that there is some nonzero probability that a loan beginning at one rating will migrate into another rating and should be priced accordingly. Loan migration analysis, as seen in Figure 1, allows for a much more dynamic view of pricing.[1] Credit spreads are required to incorporate the probability that a loan will move from, for example, a single-B rating either upward to B+ or A , or downward to a C or D category. When pricing the loan and determining the required credit spread above the par value Treasury yield curve, the lender incorporates the probabilities of migration from period to period.

The analysis illustrated in Figure 1, while dynamic, represents a single-period migration. In more developed models, the single-period migration is moved to multiple periods of migration over the life or tenor of the bond. The result is a view of longer term credit risk as a migration of default risk through the ratings grid. This process, seen in Figure 2, is typical of longer term migration and is sometimes referred to as a lattice approach to bond pricing. The loan is recognized as moving through time from period 0 to period 1, 2, 3, and so forth. Each time, the bond has a nonzero probability of moving from its current credit rating to another rating. Valuation, then, is determined by the probability of such movements and the market's required credit spreads throughout the bond's tenor for the states to which the bond evolves. Essentially, the bond is modeled as "the present value of the state contingent payoffs" of the credit instrument.

For the lender exposed to the modeling of interest rate movement, it is apparent that this approach is analogous to that used over the last decade for the modeling of interest-rate risk. Indeed, the techniques used in the corporate bond market to model credit risk are borrowed directly from the techniques used to model multi-year Treasury bond issues. Rather than concentrating on credit risk migration, interest rates were assumed to follow an uncertain path following a lattice dictated by the underlying volatility of interest rates over time. Then, a multi-period bond was priced for interest rate risk embedded in the instrument.

Applying this same approach to credit risk results in a much richer model of default risk and required credit spread. Together with appropriate interest-rate risk analysis, it allows the buyer to value both fixed and variable rate instruments as well as risky and risk-free issues. In the extreme, a fixed-rate bond that is subject to credit risk is valued by considering the dual dynamics of expected interest rate variability and default risk migration:

1. Interest rates will move through time causing the value of the bond to vary from its inception to its maturity.
2. The underlying credit risk

associated with the default probability of the borrower is also subject to variation or migration over time.

Going Beyond Bonds

Applying this technology to the corporate loan market would seem rather straightforward. After all, the entire mechanism of stochastic variability of interest rates and credit quality can be borrowed directly from the bond market. However, the transition is not that easy for a number of important reasons.

First, in the bond market one can utilize the full history of the corporate marketplace to obtain estimates of the underlying migration probabilities for default risk. The same cannot be said for the loan market. This is because the loan market has a fuller product array than the standard bond market. For example, it has a number of different indenture and seniority possibilities. Consequently, not all credits are plain vanilla loans—simple, unsecured, and typical of the bond market. In addition, the specific credit skills of the lending institution will affect the failure probability of the loan portfolio and the migration of loans into different ratings. Implicit in the bond market is a transition matrix that is based upon aggregate averages for all bonds. In fact, *bonds are not loans*—loan portfolios from one bank to another will have different migration histories. Moving down into middle-market lending, these differences in migration behavior probably become more pronounced. However, very few institutions have been able to build the required migration history because they do not have consistent risk-rating definitions over longer periods of time, and they have simply not collected and organized the data. The ultimate goal would be to utilize loan-specific migration matrices to value the underlying credit risk associated with the standard loan. In the near term, before the requisite default migration history is available, bond market migration data are probably rich enough to support the large corporate and upper middle market migration information requirements.

> APPLYING THIS SAME APPROACH TO CREDIT RISK RESULTS IN A MUCH RICHER MODEL OF DEFAULT RISK AND REQUIRED CREDIT SPREAD.

For bank loans, the payoff in default will vary according to the nature of the lending relationship, the historical franchise of the bank, and the ability of the bank to monitor and recover loans that have defaulted. As a consequence, this market is different because of the idiosyncratic nature of the lending agreements associated with loans. In short, loans are not just bonds, but specific—firm-specific—lending agreements that have to be priced according to the firm-specific historical pattern of payoffs.

It is quite common for even variable rate loans to be repriced through time in response to variations in the rating or quality of the credit. Therefore, the yield spread associated with the lending agreement will adjust to changes in credit risk that affect the borrower. This is classic grid repricing, which is common in the loan market.[2]

A variable rate loan does not necessarily imply a return to par value even for the same credit risk because the underlying interest rate convention associated with a specific loan may not have a full adjustment to open market rates. For example, if one is considering 30-day repricing intervals associated with a six-month line of credit, it is possible that the loan value will vary through time strictly because of the interest rate conventions associated with the underlying loan, for example, LIBOR versus prime versus CMT Treasury.

Loans frequently have other repricing opportunities, for example, front-end fees or periodic fees embedded in the loan contract. These, too, must be incorporated into the underlying valuation at each relevant period of time to accurately value the loan product. Again, the unique characteristics of the loan market require that, at each point in time, accurate information concerning not only credit and interest rate movements but also pricing conventions be incorporated in the valuation of the unique loan contract. The same can also be said about seniority. This must be recognized to the extent that seniority structures change over time as a result of monitoring that shows material adverse conditions developing in

the borrower. It has long been known that seniority will play a role in recovery in the state of default. Consequently, seniority structures also must be recognized in the valuation of the loan.

Prepayment risk is inherently part of any commercial lending contract. Much has been done in the mortgage market to estimate prepayment risk. In the loan market, by contrast, the prepayment risk is rarely managed or estimated. The appropriate strategy to deal with prepayment risk is to examine the underlying prepayment patterns associated with the bank's specific customer group and to both estimate and manage the prepayments as part of the underlying valuation process. In fact, in terms of embedded optionality in commercial loans, prepayment risk has a very substantial effect.

In the end, therefore, the loan market has to incorporate the kind of dynamic analysis that is embedded in the bond market. It must then go beyond bond-market valuation techniques to consider explicit structural elements that affect the timing and value associated with the loan's possible cash flow sequence. It must recognize into the future loan and firm-specific transition matrices, payoff given default, and the cash flow in every state in the U.S. This kind of analysis, however, requires a rich model of the dynamics of a particular loan. It is this approach that has been incorporated into the model presented here.

KPMG's LAS[SM] (Loan Analysis System) incorporates all aspects of the loan market. The underlying multiperiod migration of the state contingent payoffs of a loan are contained in the model. In addition, the entire array of additional structural elements are incorporated. Figure 3 illustrates the elements of structure included and shows the full array of variations that are part of the loan model. It also considers all those factors that affect cash flows.

Figure 3

Structural Elements in the LAS Model

Elements of Structure	Cash Flows
• Loan type—term, revolver, LC, and BA	• Loan principal (-)
• Fixed or floating interest rate	• Upfront fee (+)
• Fees	• Periodic fees (facility,commitment) (+)
• Principal repayment	• Interest payments (base rate +spread) (+)
• Grid pricing	• Principal repayments (+)
• Call protection	• Prepayment penalty (+)
• Collateral	• Cost of funds (-)
• Debt seniority	• Origination and underwriting costs (-)
• Interest rate caps, floors, & collars	• Administration and monitoring
• Financial covenants	

Specifically, it considers various loan types, interest-rate conventions, fees, principal repayments, grid pricing, protection, collateral, seniority, interest rate caps, and financial covenants because each of these have an effect on the valuation of the loan. In addition, all aspects of cash flows, both today and in the future state-contingent periods, are incorporated into the process of analyzing and valuing commercial loan contracts.

To achieve this, the model allows for a full array of future states in multidimensions. The result is a net present value that is analogous to the pricing of bonds but is much richer. It allows for pricing a loan's structure as well as dynamic credit risk. The approach adopted here will quantify the effect of structure on value, deal with the embedded options, recognize the effect of time or maturity on both risk and revenue, and account for the migrations. In short, it will incorporate all of the market's information as well as the firm-specific information into the underlying loan analysis.

The result of this analysis is a better model of loan value. For the first time, the bank loan market can use the techniques used in the bond market, but add to them the recognition that, indeed, bonds are not loans and that loans have unique characteristics that must be appropriately priced.

The Results of the Analysis

Approaching the problem of valuation in this way allows

for the application of standard financial techniques that are now employed in both the bond and derivative markets to be applied to the loan market. The resultant framework looks at the state contingent payoffs in each possible state in the future associated with the migration of the loan due to both credit risk variation and interest rate variation. The contingent payoff varies in each state because of the nature of the structure, grid repricing, and re-initiation of periodic fees. The migration through the structure will be firm-specific or can revert to more standard historical industry models if this is all that is available. It should be recognized, however, that an appropriate use of such a model would make the transition probabilities a function of the underlying credit approach used at the particular bank. Then, a simple migration model for the specific institution could be used to value the loans in the entire portfolio.

This approach is consistent with the newer proprietary models used for other financial instruments in the investment banking community and analogous to the models used in proprietary trading in other fixed-income assets on trading floors throughout the world. What is unique about this approach, however, is that it is adapted specifically to the loan market and can be implemented uniquely for a particular bank's history, pricing, and migration structure. It allows for this knowledge to be applied to the underlying valuation of an individual loan and a portfolio of loans through time.

When fully implemented, the loan model also can be used to analyze an aggregate loan portfolio's overall credit risk profile and structure. Specifically, the lender could imagine a model in which the transition matrices for individual loans were cross-correlated, perhaps associated with industry correlations or some other systematic risk factor. Then, the lender could develop not only the state contingent value of a particular loan but also a variance-covariance structure for the loan portfolio as a whole. This would permit the bank to structure a loan portfolio with recognition of the covariation in state contingent payoffs.

To implement this portfolio analysis, more would have to be known about the cross-correlation of loan transitions between individual credits in loan portfolios. One would need to develop estimates of the distinct correlation between individual loans perhaps associated with industry, regional, or some other systemic risk factor correlations. In individual loan transaction analysis, the current model using state-contingent payoffs that incorporate interest rates, migration, credit risk, structure, and option valuation provides substantial payoffs relative to what institutions currently use.

The Benefits of an Accurate Loan Pricing Model

An example of results obtainable from this kind of modeling procedure can be seen in Figure 4. Here, a specific loan is considered—a $450 million syndicated loan to XYZ Manufacturing Company, originally rated as a BBB-. The loan was priced at 30 bp over LIBOR with a 17.5 bp facility fee. It also allows for a bullet amortization with quarterly interest rate resetting. It is presumed to be unsecured, but subject to repricing over LIBOR through time using standard grid pricing conventions.

If the lender evaluated this

Figure 4

The Benefits of Such a System

XYZ Manufacturing Company

$450 MM Syndicated Loan

Origination rating: BBB-

Originated: 3/12/97
Expires: 3/12/2002

30 bp spread to LIBOR
17.5 bp facility fee

Bullet amortization
Quarterly i rate reset
Unsecured

$-1.132 MM NPV

"No Prepayment" NPV

$-619k NPV

deal using a simple present value of the loan based upon its current rating, it could obtain a value for the credit. However, it would be of little use. Indeed, most traders in the marketplace would not even consider the value of the loan using a static model as just described. Rather, the standard approach in the bond market would be to look at loan value using migration data associated with the bond market over the multiperiod loan horizon of five years. Approaching the valuation in this manner, the lender would find that the value of the loan, without the current pricing grid but allowing prepayment, is below par at minus $1.13 million.

The loan in question would have a significantly different value if the prepayment option was disallowed while still keeping out the original pricing grid. This point is illustrated in Figure 4 by evaluating the loan contract with a condition that prohibits prepayment before the five-year due date. In this case, the loan becomes more profitable as the bank has the potential for gain from the positive spread over the full term. This example's use of a no-prepayment option improves the value of the loan. This alteration to the loan's structure raises its net present value by approximately a half million dollars. This improves the loan's NPV to minus $619,000, but it is still below par.

Figure 5 incorporates more structure into the valuation process by returning to the original loan. Specifically, assume that the loan will be repriced according to the original terms using the original pricing grid, that is, the grid that existed at the time of loan initiation. The existing grid is reproduced on the left-hand side of Figure 5 and shows that rating declines are associated with credit spread increases. The loan is repriced under the assumption that the spread varies with changes in credit quality results in a further improvement of the present value of the loan by approximately $400,000. The net result is that the loan is now slightly less than $200,000 from par value.

The underlying credit pricing in the example is based upon the credit spreads of the first quarter of 1997, when both the add-on for credit risk and the facility fees were relatively tight by historic standards. The original pricing grid only protects the bank with higher spreads from two ratings downgrades to BB. However, using a modified pricing grid, Figure 5 notes that the value of the loan moves from a negative value to positive territory. Now, the loan's spread over LIBOR will be adjusted upward to 150 bp at BB-, providing a significant increase in revenue under potential migrations to BB- over the loan's term and increasing more than $500,000 in NPV, when the one additional ratings grade is added to the grid.

The net result of this analysis of both migration and structure is that the loan, considered unprofitable when the lender used standard techniques, is shown to be profitable. However, this is only true because the individual institution had the ability to value the effect of varying the loan's structure. It should be noted that this is a very simple example of the power of this new capability. Overall, understanding the value of structure and embedded optionality provides powerful arbitrage opportunities because these loan features tend to be more opaque in the loan market.

Figure 5

The Example Continued

Ratings Card		
Rating	Spread	Facility Fee
AAA	20 bp	10 bp
BBB+	22.5 bp	12.5 bp
BBB	25 bp	12.5 bp
BBB-	30 bp	17.5 bp
BB+	50 bp	25 bp
BB	70 bp	30 bp
BB-	150 bp	50 bp

Existing Grid Net Present Value (prepayment allowed)

Modified Grid Net Present Value (prepayment allowed)

+320,000; NPV Added 516,000 in additional

Summary

Growing competition, convergence of the loan and capital markets, and the greater complexity of commercial loan structure have heightened the need for banks to manage loan profitability in a more sophisticated way. This is true for the management of individual transactions and for the loan portfolio as a whole. To do so, each loan must be valued more accurately to account for the credit risk embedded in the loan, loan migration, its structure, and subsequent periodic fees and repricing agreements. In short, loans must be priced in a much more dynamic and complete way than is the case today. A methodology that allows this pricing provides the additional benefit of customized structuring of loans to meet individual customer requirements.

To do so, however, requires that banks acquire a deeper understanding of loan valuation and apply the newer techniques of the bond market to the loan market. Specifically, the new standards of credit analysis require the following steps to be taken:

- Loans must be accurately *rated*, *monitored*, and *tracked* through time. This history will prove important not only for the existing loan, but also for all subsequent loans that can benefit from applying the migration pattern that is unique to the specific institution.
- The credit officer must more accurately value the *underlying pricing conventions* built into the loan market. These are often neglected when loans are priced as bonds. The existence of a repricing grid, a periodic fee structure, and various repricing techniques are often neglected in favor of the assertion that loans are merely small bonds.
- *Structure* must be more *accurately priced*. Towards this end, it is necessary for the individual institution to recognize that structure has value. It should be quite apparent that the options embedded in the loan portfolio have value; we have known the value of options embedded in bonds for some time. As the derivative market has expanded, we trade these options that are part of the collective loan agreement in isolation. It is incumbent upon the banking community to more accurately price these options and to incorporate them into the pricing of loans which have embedded options.

THE NET RESULT OF THIS ANALYSIS OF BOTH MIGRATION AND STRUCTURE IS THAT THE LOAN, CONSIDERED UNPROFITABLE WHEN THE LENDER USED STANDARD TECHNIQUES, IS SHOWN TO BE PROFITABLE.

These steps would lead to an improvement in the ability of banking institutions to value their loans, define their required spreads, and to aggressively and accurately compete. Structure and repricing are powerful tools to be employed in the competitive financial community. At the moment, however, structure is often given away and options are often neglected in competitive bidding. Banks can compete more effectively for their customers and have higher yielding loan portfolios to the extent that they have the ability to price the value of these options, to use the repricing of the credit spread, and to know the migration of credit quality that is specific to the credit portfolio of their particular bank.

There is no question that the market for credits is under severe competitive pressure. In such an environment, knowledge of the underlying portfolio and its value is the only true weapon for successful competition. Those that lag behind will be gamed by competitors and gamed by their customers. They will find they are subject to what academics call "the winner's curse." They will lose the good deals and win the bad ones. In today's world, information about the underlying lending relationship and the specific characteristics of the loan product is the only adequate defense for a successful banking firm. ❐

Notes

[1] The risk grades depicted in Figure 1 are meant to be illustrative. The public bond market uses an 18-pass grade system while banks own internal risk-grading systems range from four pass grades to 18 pass grades that are aligned with the public bond market.

[2] Grid repricing is also referred to as step-up, step-down, or performance-based pricing.

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