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Incorporating New Fixed Income Approaches into Commercial Loan Valuation

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Section 1 - Introduction

Competition in the commercial loan market has increased dramatically over the last decade. This is true for a number of reasons. First, 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. Second, 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. This, in turn, has caused additional pressure on spreads in the marketplace. Third, given the well known cycle in credit spreads, we are now facing a market in which credit spreads are exceedingly tight. As a result of the recent contraction in the credit spreads across all credit ratings, individual banks are now facing a pricing grid with an unprecedented and unreasonable compensation for the risk borne. Fourth, competitors and customers have learned more about the value of structure. As a result, banks have been suffering from inappropriate pricing of the imbedded options built into their loan products.

The net result is that many bankers are building loan portfolios that do not cover their true costs, i.e., the cost of funding, the level of the risk, and the nature of the imbedded options contained in the loan contract. In order to remedy this situation, the banking industry will have to 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. It is the case for several reasons. First, it is a market that is highly contested with the investment banking and insurance sectors vying for first class customers. Second, 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 the tight spreads being more pronounced in this market area.

The appropriate and prudent action on the part of senior credit officers is to tighten up the standards in reaction to this situation 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 the enforcement of required minimum spreads on loan deals. As always, this is easier said than done, for accurate loan pricing has always been a difficult process.

Specifically, it is well known that banks have insufficient knowledge of the underlying cashflows imbedded in their individual loans and aggregate loan portfolio. In addition, they 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 the recent developments in the bond market and apply the recent advances that have occurred there to the key issue of appropriate loan pricing. Recently, the bond market has revolutionized the way that 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.

Section 2 - Incorporating Bond Models into the Loan Market

The traditional approach to bond valuation had been to link the required credit spread of an issue to its ratings supplied by Moody's and/or S&P's standard analysis. They, in turn, assign a risk rating which is related to the probability of default over the foreseeable future. The net result was that a rated issue acquired an initial spread that was directly related to the market demands for yield in the seasoned bond market.

However, it has been shown that this is a static—rather than dynamic—approach to default probability and therefore pricing. Recent work by Jarrow and Turnbull (1997 for

example), and a number of other fixed income researchers, has illustrated that in order to adequately incorporate default probabilities in pricing an instrument, it is necessary to look more closely at the dynamics of the credit risk imbedded into a fixed income instrument. This is done through the use of the migration analysis whereby the evolution of bond risk rating is carefully studied. It derives from a recognition that there is some nonzero probability that a loan beginning at one rating will migrate into another rating, and accordingly has to be priced given this potential migration. This is indicated in Figure 1 and allows for a much more dynamic view of pricing. Employing this methodology, 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, one incorporates the probabilities of migration from period to period.

The analysis illustrated thus far in Figure 1 is, in fact, dynamic but only 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 is captured graphically in Figure 2 and it is typical of this kind of migration, 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 and 3, etc. 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 reader who has exposure 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 Treasury multi-year bond issues. There, 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 is priced for interest rate risk imbedded 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 risk analysis, it allows the buyer to value both fixed and variable rate instruments, and 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. First, interest rates will move through time causing the value of the bond to vary from its initiation until its maturity. Second, the underlying credit risk associated with the default probability of the borrower is also subject to variation or migration over time.

Section 3 - 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 in order 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. To the individual credit department, this is of little or no use. If, in fact, bonds are not loans, then loan portfolios from one bank to another will have different migration histories. Each institution, therefore, must have different transition matrices in order to value the underlying credit risk associated with the standard loan.

A second point of difference relates to payment given default. 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.

Beyond this, loans are different for a number of other reasons. The third in our list is that 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 vary from period to period based upon a reevaluation of the inherent credit risk of the borrower. This is classic grid repricing which is common in the loan market.

Fourth, 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 6 month line of credit, it is possible that the loan value will vary through time strictly due to the interest rate conventions associated with the underlying loan, e.g., LIBBOR vs. Prime vs. CMT Treasury.

Fifth, loans frequently have other repricing opportunities, for example, front end fees or periodic fees imbedded 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 be said about seniority. To the extent that seniority structures change over time, as a result of monitoring which shows material adverse conditions developing in the borrower, this must be recognized. It has long been known that seniority will play a role in recovery in the state of default. Consequently seniority structures is the sixth point that needs to be recognized in the valuation of the loan.

Last, but not least, prepayment risk is inherently part of any 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 the end, therefore, the loan market has to incorporate the kind of dynamic analysis that

is embedded in the bond market, but go beyond bond market valuation techniques. It must consider explicit structural elements that have impact on the timing and value associated with the loan's possible cashflow sequence. It must recognize loan and/or firm specific transition matrices, payoff given default, and the cashflow in every state into the future. In order to do this kind of analysis, however, one needs a rich model of the dynamics of a particular loan. It is this approach that has been incorporated in the model which we present here.

Specifically, the work that has been done in KPMG's LAS (Loan Analysis System) incorporates all aspects of the loan market. The underlying multi-period 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 impact cash flows. 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 cashflows both today and in the future, state contingent, periods are incorporated into the structure of loan analysis.

In order to achieve this, the model allows for a full array of future states in multi-dimensions. The result is a net present value that is analogous to the pricing of bonds, but much richer. It allows for pricing structure and firm specific migration. The approach adopted here will quantify the impact of structure on value, deal with the imbedded 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 in 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.

Section 4 - 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 credit risk variation and interest rate variation. In each state the contingent payoff varies because of the nature of the structure, grid repricing and/or 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 uniquely to 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 could also be used to a model of portfolio structure, although we have not yet done so. Specifically, one could imagine a model in which the transition matrices for individual loans were cross-correlated, perhaps associated with industry correlations. One could then 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.

However, pushing the model too far in this direction would be difficult, at least given the current state of knowledge about loan migration. Specifically, 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 correlations. While there is much work to be done here, our model does not pursue this matter, at least at the present stage. Nonetheless, the current model using state contingent payoff that incorporates interest rates, migration, credit risk and structure is consistent with a movement in this direction and has a substantial payoff in the present context.

Section 5 - The Benefits of an Accurate Loan Pricing Model

To see results obtainable from this kind of modeling procedure, we refer to Figure 4. Here, a specific loan is considered, viz., a $450 million syndicated loan to Penncorp Financial, 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 a quarterly interest rate resetting. It is presumed to be unsecured, but subject to repricing over LIBOR through time using standard grid pricing conventions.

If one were to evaluate this deal using a simple present value of the loan based upon its current rating, one 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 multi-period loan horizon of five years. Approaching the valuation in this manner, one would find that the value of the loan is below face value due to the potential for downside migration. The economics here is quite simple. Even using standard bond migration data, the probability of drifting downward from a BBB- has a negative impact on the valuation that is greater than the positive value from migration to a higher credit rating.

However, the loan in question would have a significantly different value with a no prepayment option. To illustrate this point, we evaluate 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. As indicated in Figure 4, the use of a no prepayment option in this example, based upon a simple migration of a standard BBB- loan, improves the value of the loan. This addition to the structure raises its net present value by approximately one half million dollars.

Turning now to Figure 5, we incorporate more structure into the valuation process. Specifically, assume that the loan will be repriced according to original terms, using the original pricing grid, i.e., 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. Notice that the repricing of the loan 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.

Finally, consider the pricing grid itself. 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 extraordinarily tight by historic standards. To the extent that the grid returns the historic average over time or is expected to do so over the tenor of the loan, there will be additional value associated with the lending facility as spreads increase to historic average levels. Using a modified pricing grid, Figure 5 notes that the value of the loan moves from a negative value to positive territory, and increases in NPV by over $500,000.

The net result of this analysis of both migration and structure is that the loan, which was once unprofitable, or considered so using standard techniques, is shown to be profitable. However, this is only true because the individual institution had the ability of tracking loan migration and varying the structure of the deal.

It should be noted, however, that this is a very simple example of the power of this new capability. Very little was required except knowledge of the loan structure options available and the historic credit spread in the pricing grid. It even used the open market migration probabilities imbedded in the Moody's tables. To the extent that the loan is priced based upon migrations that are firm specific, the result may be even more dramatic. Whether it will result in an increase or decrease in value, however, depends upon the credit migration pattern of the specific bank in question. It is unquestionably the case, however, that this pattern will be different than that which is obtained from the Moody's estimates obtained from the bond market.

Section 6 - 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 their loan portfolios in a more sophisticated way. This is true for the management of individual transactions and for the loan portfolio as a whole. In order to do so, each and every loan must be valued more accurately to account for the credit risk imbedded 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.

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 to credit analysis require the following steps to be taken:

(a) 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 the migration pattern that is unique to the specific institution.

(b) 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.

(c) 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 imbedded in the loan portfolio have value; we have known the value of options imbedded 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 imbedded options.

To do all this would result in an improvement in the ability of banking institutions to value their loans, define their required spreads and to both aggressively and accurately compete. It is

often the case that 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 portfolio 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 is the only adequate defense for a successful banking firm.

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Figure 1
The Basics of Loan Migration

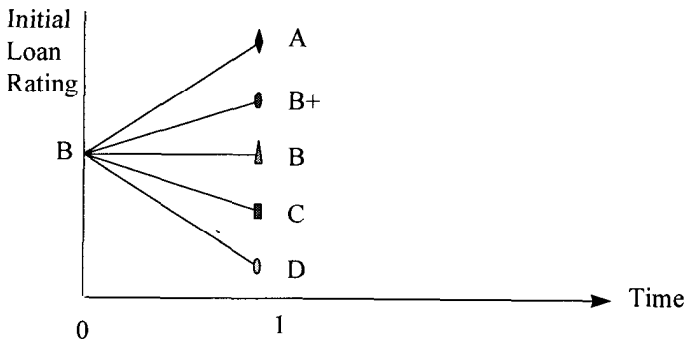

Figure 2
The multi-period loan migrates over many periods

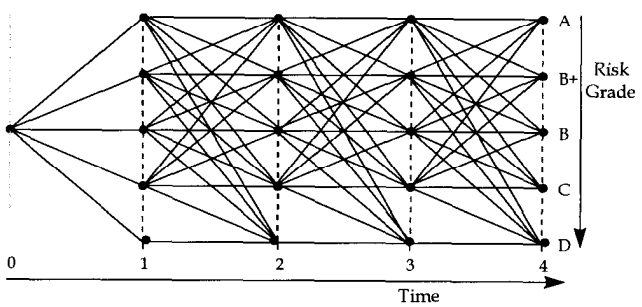

Figure 3
Structural Elements in the LAS Model

Elements of Structure
- Loan type--term, revolver, LC, and BA
- Fixed or floating interest rate
- Fees
- Principal repayment
- Grid pricing
- Call protection
- Collateral
- Debt seniority
- Interest rate caps, floors, & collars
- Financial covenants

Cash Flows
- Loan principal (-)
- Upfront fee (+)
- Periodic fees (facility, commitment) (+)
- Interest payments (base rate + spread) (+)
- Principal repayments (+)
- Prepayment penalty (+)
- Cost of funds (-)
- Origination and underwriting costs (-)
- Administration and monitoring (cost of carry) (-)
- Loss in the event of default (-)

Figure 4
The Benefits of Such a System - An Example

Penncorp Financial

$450 Mil 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
Ratings-driven grid pricing

"No Grid" NPV

$-1.132 mil NPV

"No Prepayment" NPV

$-619k NPV

Figure 5
The Example Continued

Ratings Grid:

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

Existing Grid NPV
(prepayment allowed)

$-196k NPV

Modified Grid NPV

$+320k NPV

Added $516k in extra NPV