Shrewd pricing and structuring of loans can enable a bank to satisfy customers' needs while meeting its own risk/return requirements. This article describes a pricing method that uses net-present-value analysis to examine trade-offs between price and structure.

CREATING VALUE FROM BOTH LOAN STRUCTURE AND PRICE

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In today's increasingly competitive loan market, bankers no longer can rely solely on smooth operational efficiency, sensible control systems, and strong relationship management. They must combine these capabilities with refined risk quantification and proficient loan pricing and structuring.[1] Financial institutions with superior skills in these areas can generate substantial economic benefits; others are likely to struggle.

This article discusses loan pricing and structuring.[2] In our view, shrewd pricing and structuring of commercial loans can take advantage of interesting *arbitrage opportunities*.[3] Thus, if a lender can assess the value of a subtle strengthening of structure, that lender can offer an obvious price reduction, but one that still maintains economic value for the lender, thereby increasing the chances of originating a profitable deal. Alternatively, if a borrower places undue value on another aspect of structure, the informed lender can loosen that feature and more than offset this concession by tightening some other structural elements or by increasing spread or fees. Again, this helps the lender originate at a profit.

For this process to work, the banker must have a way to assess price/structure trade-offs properly.[4] Otherwise, the bank gaining market share may be doing so by originating unprofitable deals. To close the best deals possible, the bank must be able to put an economic value on the total loan package, including structure and price. Such a bank will be in a position to win more business on profitable terms.

The banker must have a way to assess price/structure trade-offs properly.

This article presents a new technique for analyzing the entire loan agreement. This approach evaluates both dynamic, multiyear credit risk and loan structures including embedded options. The approach adapts arbitrage-free derivatives-pricing techniques to the special characteristics of the commercial loan market. It helps not only

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with loan origination but also with relative value analysis, trading, securitization, and active portfolio management.

To put this new approach in context, we begin by reviewing two methods that bankers currently use in analyzing and pricing commercial loans. We then describe the Loan Analysis System℠ (LAS) approach developed by KPMG. We illustrate the LAS by using it to analyze a few large corporate and middle-market deals. We conclude the article by discussing the business case and highlighting the process and technology issues involved in implementing an LAS approach to loan valuation. Successfully achieving the business benefits of leading-edge decision support requires an integrated approach that links to both business process and technology.

HOW DO BANKERS ANALYZE AND PRICE COMMERCIAL LOANS?

In our experience, most bankers today analyze and price commercial loans in the following ways:

- calculating the average all-in spread from a sample of recently issued loans or bonds that, with adjustments, provide plausible estimates of par market pricing for the current deal;
- using a model that estimates the all-in spread needed to pay for the annual costs of origination and administration, the annual expected losses, and the required rate of return on capital set aside to cover the (unexpected) credit, market, and operational risks.[5]

We call the first approach comparables analysis and the second risk-adjusted return on capital (RAROC) model pricing.[6] We review strengths and weaknesses of each of these approaches next.

Comparables analysis

Comparables analysis provides a simple pricing process, free from what may be inaccurate simplifications of modeling. The approach looks directly to the market for pricing information. Thus, it keeps current with the market's view of risk. This stands out as a key virtue. This approach works best for standardized products traded in liquid markets. Commercial loans, however, have become complex, linked to other credit and noncredit products and services, even customized, and they trade infrequently.

Comparables analysis looks directly to the market for pricing information.

In our opinion, the loan market still is neither liquid enough nor broad enough to be a reliable source for more than generic pricing estimates. We agree with Loan Pricing Corporation's (LPC's) practice to publish only general indicators of current market pricing for loans of different grades. LPC regularly publishes only one market price proxy (for drawn and for undrawn) for each of 12 credit grades, undifferentiated by term and other details of structure. We believe that the current market supports reliable statistics at that broad level of detail at best.

Further, the importance of nuances in loan structure and in the risk profile of different deals makes it extremely difficult to find a sufficient sample of comparables for any particular transaction. This is especially true when one tries to enlarge the sample by turning to the bond market. One might expect to find more efficient pricing for risk in that more heavily traded market. For determining general indicators of credit pricing, this might be so. However, bond structures differ quite substantially from those found in bank loans. For example, the pricing is fixed rather than floating rate, there are almost no pricing grids, and the covenants are looser. Also, loans typically trade at a premium relative to comparable bonds, highlighting the fact that structure matters. This makes it very difficult to find a set of close comparables from that neighboring market.

RAROC model pricing

As an alternative to comparables analysis, one may use models designed to price for credit risk. Today's credit-risk-pricing models at banks derive mostly from efforts to measure risk-adjusted returns on capital (RAROC). The RAROC approach can work well at the enterprise and per-

haps the line of business level. Its use in pricing commercial loans can, however, be problematic.[7]

RAROC charges for risk by allocating capital. Higher-risk ventures receive more capital. To be viewed as profitable, a business must generate annual income exceeding the amount needed to pay a hurdle rate of return on the assigned capital. Most financial firms set the hurdle rate at the estimated combined cost of debt and equity capital for the total enterprise. They typically derive the capital-allocation rules from a target rating (for example, AA), the associated one-year loss rate (which implies its standard deviation), and a correlation coefficient. The correlation coefficient presumably measures the rate at which risk at the unit level contributes to the overall enterprise. However, the quantification of this effect often appears murky. In principle, however, a business unit should receive capital in an amount proportional to the unit's contribution to the enterprise's annual systematic loss risk.

RAROC systems have found popularity at banks over the last decade. They provide a simple risk-adjustment technique that seems consistent with the intuitive notion that banks hold scarce capital to cover risk. Applied properly, the method works reasonably well for the total enterprise. However, when applied to business lines or smaller units, the method starts to break down.

This, in part, reflects RAROC's neglect of deal structure. Consider a lending unit that responds to increasing competition by offering looser structured deals to all of its borrowers (for example, prepayment options, 'bad' grids). The unit deserves an increasing risk charge. To a typical RAROC system, however, nothing has changed. As noted below, this can create substantial problems for individual transactions. Over short time periods in which average structure changes little, it creates only small problems at the business-line level.

RAROC systems have found popularity at banks over the last decade.

More fundamentally, RAROC's method for calculating risk costs seems too distant from the market. The method seems deficient on two counts. First, RAROC ties capital costs to bankruptcy avoidance. This implies that correlations with the enterprise's own portfolio get all of the attention. Most market pricing models have a distinctly different emphasis.[8] In estimating equity capital, the main RAROC capital-cost component, the Capital Asset Pricing Model (CAPM) and Arbitrage Pricing Theory (APT) Model ignore bankruptcy as a negligible factor. Those models focus instead on the much greater risk of losing some, but not all, of equity. The CAPM and APT emphasize correlations with the overall market, not an institution's particular portfolio.

Second, RAROC stays remote from current market information on risk. However, market pricing appears dynamic, reflecting changing expectations about inflation and overall business volatility. Thus, market prices fluctuate more than the near-static RAROC framework is able to accommodate.

These shortcomings magnify at the transactions level. Consider the problems caused by RAROC capital charges being unrelated to the market's current valuation of prospective credit risk. This often causes RAROC prices to diverge widely from the market. Consequently, relationship managers (RMs) frequently regard transaction-level RAROC as irrelevant or as an impediment to business.

Consider the problems caused by the neglect of loan structure. This makes RAROC blind to much of a loan's value, especially the part offering arbitrage opportunities. In addition, this may create incentives for looser, higher-risk structures.

A NEW APPROACH TO PRICING AND STRUCTURING COMMERCIAL LOANS

Over the past two years, KPMG has developed the LAS to address the problems with today's pricing methods and retain all of the best features. Fundamentally, the LAS is a net-present-value (NPV)-based approach to credit risk pricing that analyzes the total loan package, structure and price. Further, the system is calibrated to current market prices. (For comparison, however, the user may calibrate to internal standards as well as to the market.) Specifically, for each of the 18 S&P or Moodys credit grades, we enter current par credit spreads for one-year option-free term loans into the LAS.[9] Then, consistent with these market-based prices, the LAS computes values for a rich variety of differently

structured loans.

In what follows, we outline the kind of NPV approach that forms a leading-edge foundation for analyzing, pricing, and structuring commercial loans. The method applies derivatives valuation techniques, adapted to the special features of commercial loans. This approach involves the following steps:

- modeling dynamic credit risk using detailed risk rating transition behavior;
- assessing the value of a wide range of loan structures including embedded options;
- evaluating unexpected losses using market-based credit risk premiums;
- providing substantial risk analysis benefits through a what-if capability;
- incorporating loan origination and carrying costs.

NPV and decision tree analysis

An NPV approach evaluates a loan as the net present value of its expected future cash flows. This approach starts with estimating the cash flows, conditional on expected future ratings. For commercial loans, the cash flows depend not only on prices (spreads and fees) but also on embedded options and their exercise strategies. The lender exercises some options, such as covenants allowing repricing or restructuring. The borrower exercises others, such as prepayment, drawn amount, or choice of base rates. Typically, we find that the borrower options in general, prepayment in particular, have the largest economic value contribution.

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We use a decision tree framework to characterize risk and the borrower and lender options. Consider a simple example in which, at each time point, borrowers fall into one of four ordered nondefault ratings states (A, B+, B, and C) or into default (D). We consider the default state absorbing. Like death, once the borrower enters this state, it stays there.

Suppose the borrower has a B rating at origination and issues debt with a term of four periods or time steps. We use a tree diagram, mirroring the NPV algorithm, to trace the evolution of credit risk *(Exhibit 1)*. The NPV approach begins by estimating the cash flows when the loan matures (at time step 4). At this point, we can easily determine the loan cash flows. Either the loan pays off principal, interest, and fees in full (states A, B+, B, or C), or the loan defaults and pays off only partly (state D). If the borrower defaults, the lender receives a recovery fraction influenced by seniority, loan covenants, and especially the value of any pledged collateral.

Now step back one period before maturity. Select one of the possible ratings states (for example, B). Looking forward, we can compute the expected value of the loan if it continues. We use the known transition probabilities (from B) to average the known period-4 cash flows. We then discount back one period and add any cash flows owed in period 3. This becomes a preliminary estimate of the loan's value at that ratings state (B) in period 3.

This result stands only if both borrower and lender choose not to exercise any options that they may hold. Consider the prepayment option. If the above calculation yields a value larger than the prepayment cost, the algorithm assumes the borrower prepays the lesser amount. Then that lesser amount becomes the period-3 value at that ratings state. Otherwise the earlier value remains valid. Repeating this process for each of the possible ratings states, we get all of the state-dependent period-3 values.

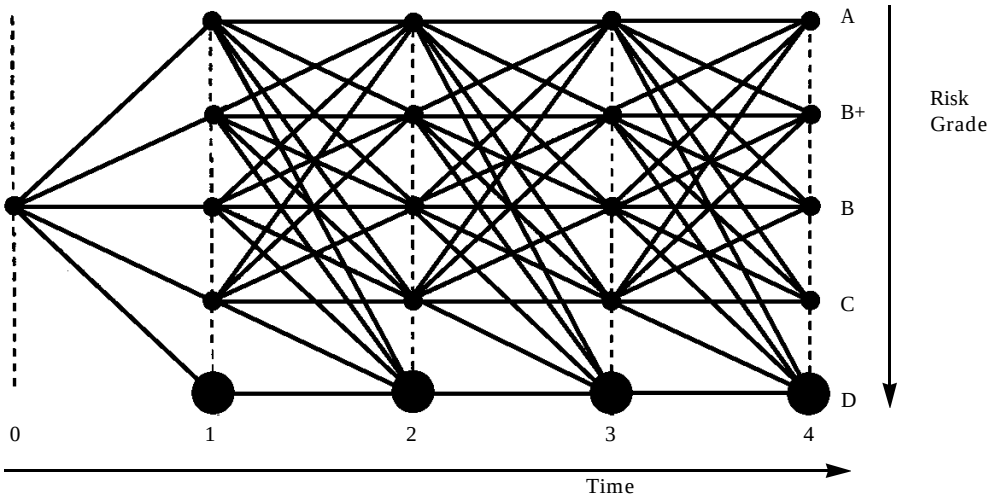
If we continue this process going backwards in time, eventually, we get back to period 0 (the origination date). Here we have only one possible rating, the starting credit grade. The value obtained at that point is the value of the loan.

This backwards recursion process represents the standard method of valuing most state-dependent assets. The procedure handles the vast majority of credit-related events and options important to loan analysis.

Risk rating transition behavior

Risk rating transition probabilities stand cen-

EXHIBIT 1
Tree Diagram Traces the Evolution of Credit Risk



tral to this NPV analysis technique. The cash flow determinants influenced by ratings and ratings transitions include the following:

- borrower prepayment,
- pricing grids,
- revolver usage.

Ideally, one would use migration rates tied to the bank's ratings and borrowers. We are aware of very few banks that have sufficient data consistently describing their own experience. As an alternative, banks can map their risk ratings to those of the agencies that rate public debt. They then may use the transition rates tabulated for those bond issuers.

The LAS allows the user to enter the transition matrix or a series of matrixes for different time periods. For those who haven't calculated their own matrixes, we provide a series developed from an average of Moodys' and S&P's experience. Moodys and S&P have tabulated more than 20 years of historical data describing the ratings migrations of publicly rated companies.

Loan structure and options

As mentioned above, loan structure and options have value to the lender. Prepayment stands out as an option, usually included in loans, that substantially diminishes the value to the lender. Bankers have an intuitive grasp of the inherent value of a prepayment option. The NPV approach translates this intuition into dollars.

Using the NPV approach, we are able to deduce a dollar value for grid pricing (also called performance pricing or step-up step-down pricing). For publicly rated companies, ratings changes often trigger repricing under a grid. For nonpublic borrowers, loans tie repricing to values of selected ratios related to financial performance. Some grids (in project finance deals) also depend on draw dates. Using the NPV approach, the lender can distinguish between 'good' grids providing value to the bank and 'bad' grids that subtract economic value.

Overall, the NPV approach is flexible relative to the kinds of loan structures and options that can be analyzed. The elements of structure briefly discussed above are meant as examples.

Modeling unexpected losses using contingent claims models

As noted, NPV analysis can be calibrated to current market prices for risk. Observed spreads, however, include more than pure risk compensation. They also cover the annualized cost of administering the deals.

We most clearly see this "cost of carry" component in highly rated deals. For example, one- to three- year A and AA deals currently show par drawn spreads of about 16 to 17 basis points

(bps). However, even an extremely pessimistic review of historical loss experience suggests that credit-risk costs in short-term A and AA deals should be extremely low, no more than 1 to 2 bps. Thus, we conclude that the cost of carry for highly graded loans must average about 15 to 16 bps.

More generally, market prices confound risk with cost of carry. We need to disentangle these two elements, isolating the generic credit component. Only then will we have the information needed to properly analyze the credit-related components of loans such as the prepayment option and pricing grids.

Market prices confound risk with cost of carry.

We use a contingent-claims-modeling approach to derive an independent assessment of credit-risk spreads for each grade. Then, by deducting those estimates from the observed historical average par spreads, we obtain an initial estimate of cost of carry for each grade. These cost-of-carry estimates as well as the corresponding credit components surely include statistical noise; therefore, they must be smoothed before being used.

The contingent-claims model assumes that default occurs if the value of the firm falls below a threshold proportional to the value of debt. We calibrate the model to observed historical default rates. Specifically, for each of the 18 S&P ratings grades, we fit the model by least-squares regression to the historical average 1- to 10-year default rates. For each grade, the model has two parameters: (1) an initial (time=0) default distance and (2) the expected growth rate of asset value relative to risk. This expected growth rate includes the cost of capital as a major component.

Having fit these models to observed default rates, we then reduce the growth rate to reflect the risk-free cost of capital. Then, solving the model, we calculate somewhat higher than observed default rates. We call these risk-neutral default rates. These risk-neutral default rates, combined with historical average values of loss given default, yield estimates of credit par spreads (expected and unexpected loss). We use these theoretical credit spreads as a first approximation in the empirical process described above where we separate the observed spread into cost of carry, expected loss, and unexpected loss.

EXAMPLES USING THE NPV APPROACH

We now illustrate the use of the NPV valuation approach for two large corporate deals and one middle-market loan. We start with a $200 million eight-year term loan to a BB+ rated telecommunications company *(Exhibit 2)*. The loan has an initial spread of 75 bps over Libor and an up-front fee of 15 bps. The deal calls for the spread to step up or step down if the borrower's ratio of debt to cash flow changes materially.

Using the LAS calibrated to current market pricing, we estimate that the loan offers a positive NPV of $403,000. Thus, the loan has value of 100.20 relative to par. The loan offers an option-adjusted return on risk-adjusted capital (OARRAC)[11] *spread* of 7.3% over the risk-free rate. This exceeds the assumed OARRAC par spread of 5%. Thus, as our calculations require, the NPV and OARRAC results both imply that the loan looks profitable.

At this point, the lender may wish to evaluate whether the data on the term sheet overstates the quality of the borrower or the loan. If the lender finds the data credible, the results indicate that he or she should try for a large share of the deal.

The loan has a risk-weighted duration of 4.4 years. This indicates that it will likely prepay well before the commitment maturity date. This reflects the initial BB+ rating. Borrowers at this level have a relatively high probability of migrating up to less risky grades.

To value the prepayment option, we run the loan through the LAS algorithm with prepayment not allowed. In this case, the NPV rises to $942,000. The prepayment option has a value of about $540,000.

The lender, therefore, might try to make the loan more profitable by adding features that discourage prepayment. Consider a scaled prepayment penalty. Suppose we include a penalty of 100 bps during the first three years, dropping to 50 bps during years four and five, and zero thereafter. This loan has an NPV of $630,000 and the risk-weighted duration rises to 5.3 years. Thus, we've increased the loan's value by $230,000 by adding this five-year schedule of prepayment penalties.

Alternatively, suppose we increase the up-front fee from 15 to 30 bps and lower the spread

EXHIBIT 2
Case Example: Term Loan to a Telecommunications Company Rated BB+

S&P Risk: BB+ | Loan type: Term
Commitment: $200 million | Outstanding: 100%
Start date: 6/13/96 | End date: 6/13/04
Spread: Libor + 75, grid | Up-front fee: 15 bps
Commitment fee: N/A | Annual fee: 0

			Par Spreads		
	NPV	**OARRAC**	**Drawn**	**Undrawn**	**Duration**
Base case	$403,000	7.3%	72	N/A	4.4 years
Alternative 1: no prepayment	$942,000	9.4%	69	N/A	6.3 years
Alternative 2: prepayment penalty	$630,000	8.3%	71	N/A	5.3 years
Alternative 3: spread/fee shift	$633,000	8.2%	70	N/A	5.4 years

NPV: net present value. OARRAC: option-adjusted return on risk-adjusted capital.

by 3 bps. On the face of it, this looks like an even exchange. However, the loan's value goes up by about $230,000 and the risk-weighted duration again rises to 5.4 years. This again reflects the prepayment option. The up-front fee works like a prepayment penalty. After the borrower pays the fee, the loan looks cheap. Prepayment occurs less frequently.

Now consider a five-year $5 billion revolving line offered to a finance company with an A- rating *(Exhibit 3)*. The loan offers a spread of 17.5 bps over Libor and an annual facility fee of 7.5 bps. Thus, the drawn spread is 25 bps and the undrawn 7.5 bps. We expect the borrower's usage of the line will average 25%.

The deal looks marginally profitable. We get an NPV of $218,000. This corresponds to a value of 100.02 relative to par at average usage. The option-adjusted OARRAC spread comes in at 5.4%, just above the break-even 5% value.

Solving the LAS backwards, we get par spreads of 22 bps drawn and 8 undrawn. This again shows that the actual prices average just about par.

Given the initial high rating of A-, most of the credit risk arises after the passage of years. This allows for downward migration. To counteract these adverse migration effects, the lender might choose to add a pricing grid that includes step ups upon downgrade. We added such a grid with ratings-related pricing changes consistent with

EXHIBIT 3
Case Example: Revolver to a Finance Company Rated A-

S&P Risk: A- | Loan type: Revolver
Commitment: $5 billion | End date: 6/28/01
Start date: 6/28/96 | Outstanding: 25%
Spread: Libor + 17.5 | Upfront fee: 0
Commitment fee: 0 | Annual fee: 7.5 bps

			Par Spreads		
	NPV	OARRAC	Drawn	Undrawn	Duration
Base case	$218,000	5.4%	22	8	4.0 years
Alternative 1: pricing grid	$1,641,000	7.6%	21	8	4.3 years

LPC par spreads. The restructured loan has an NPV of $1.6 million with an OARRAC spread of 7.6%. The pricing grid has increased the loan's value by about $1.4 million.

Finally, consider a five-year $3.5 million revolving line offered to a middle-market retail borrower *(Exhibit 4)*. The borrower's bank rating is 3, representing an S&P-equivalent grade of BBB. The loan offers a spread of 40 bps over Libor with a commitment fee of 15 bps. We expect that the borrower's usage of the line will average 50%.

According to the NPV approach, the loan as it stands has an NPV of *negative* $3,880, or 99.78 relative to par at the average outstanding amount. Solving the algorithm in reverse, we get par spreads of 43 bps drawn and 20 bps undrawn. Thus, the actual drawn spread seems slightly deficient.

In an effort to bolster value, we add a term-out option, allowing repayment but no further draws over the last two years. This reduces the NPV loss to $3,411. Finally we add a pricing grid with step up and step downs patterned after LPC par pricing. This "fair" grid raises the loan's NPV to a positive value of $1,312, or a little over par. We get total value added of about $5,200, near the middle of the range of benefits per loan that we've projected based on our analysis of a sample of about 500 middle-market loans.

These results reflect potential gains in value. For the gains to be realized, RMs must sell the new deals in competition with other lenders. Thus, the LAS only starts the process by which the RM delivers added value, by assisting the lender to understand price-structure trade-offs.

THE BUSINESS CASE FOR IMPLEMENTING A NET-PRESENT-VALUE APPROACH

So far this article has discussed the analytic aspects of both current and "next generation" approaches to pricing, analyzing, and structuring commercial loans. Ultimately, we're interested in the business benefits. We now describe a framework that banks can use to understand the financial rewards of implementing an approach like the NPV analysis described above. In this framework, we identify business benefits from the following:

- improving the risk-adjusted returns earned on new and renewing loans,
- increasing revenue growth by winning more business,
- creating value through securitization and loan-trading activities,
- upgrading MIS capabilities to understand portfolio exposures,
- advancing efforts to provide better risk-adjusted performance measures and incentives.

Our discussion below focuses first on commercial lending overall. Then we provide some distinctions concerning its applicability to large corporate and middle-market lending operations. We conclude with brief comments on implementation issues and choices.

EXHIBIT 4
Case Example: Revolver to a BBB-rated Retailer

S&P risk: BBB	Loan type: Revolver
Commitment: $3.5 million	Outstanding: 50%
Start date: 8/31/97	End date: 9/1/02
Spread: Libor + 40	Up-front fee: 0
Commitment fee: 15 bps	Annual fee: 0

			Par Spreads		
	NPV	OARRAC	Drawn	Undrawn	Duration
Base case	($3,880)	–0.8%	43	20	3.1 years
Alternative 1: term-out	($3,411)	–0.7%	45	18	3.0 years
Alternative 2: term-out, grid	$1,312	6.8%	37	17	4.1 years

Improved returns on new and renewed loan transactions

A bank can use the LAS analysis to identify loan price/structure changes that increase overall risk-adjusted returns. One might accomplish this by changing the fee-spread mix to capture back some prepayment option value. Alternatively, one could introduce term-out options in revolving facilities to curtail loan utilization as risk ratings deteriorate over time.

A bank can use the LAS analysis to identify loan price/structure changes that increase overall risk-adjusted returns.

Bankers have had an intuitive grasp about these benefits. The NPV approach allows bankers to put dollar values on options and their benefits. A positive NPV change represents structure that benefits the lender; a negative change favors the borrower.

Increased revenue from incremental origination business

The approach allows the bank and the RM to compete effectively in the marketplace. The bank can identify and trade off structure against price. This allows the informed bank to offer more competitive terms and a richer set of options to the borrower. This helps increase loan volume. As one of our potential users indicated, it gives the bank an opportunity to have a conversation with the borrower that it otherwise would not previously have had. Adhering to the NPV approach, the bank can ensure that this additional volume increases rather than diminishes profitability.

Gain from securitization and secondary market loan sales

Used appropriately, the LAS can be used to identify deals with "good" and "bad" structure, relative to market pricing. The bank can then develop a strategy to sell off deals with subtle structural weaknesses unappreciated by the market. The bank can arbitrage this asymmetry of information by creating and securitizing pools of deals with "poor" structure. The business benefit is measured by the NPV difference between loans that are below par for the bank, but are perceived as at par by the market.[12]

Enhanced decision-support MIS

The additive nature of NPV allows the portfolio manager to view the sources of economic value creation. By analyzing NPV or risk-weighted exposures by geographic region, industry focus, or borrower risk rating, the NPV approach provides a clearer view of risk concentrations and profit opportunities within the portfolio, leading to effective portfolio management. In essence, NPV can be used to run the deals in the portfolio in a batch mode with the results analyzed weekly or even daily to measure credit risk exposure on a risk-weighted basis.

Better performance measurement and incentives

Perhaps the biggest benefit of the NPV approach is the *discipline* it introduces to the process of understanding profitability during loan origination. Banks can use the NPV as a standard metric that incorporates loan structure. This allows RMs greater freedom in negotiating better deals to satisfy customer needs, without sacrificing the interests of the bank.

By tying the incentive structures to NPV, the bank can align its goals of economic value creation with the compensation it offers the relationship manager. This is a significant departure from the RAROC approach, where the incentive is to give away structure that may have created economic value to get the deal.

The NPV approach also facilitates aggressive loan pricing below a bank's required return if it is important for the broader customer relationship. The bank can set a measured target that must be achieved through broader product sales and relationship management to achieve economic value from the full customer relationship. This is especially useful in situations where the participation in a marginal loan transaction is necessary to continue to derive other product revenue from the customer.

We have analyzed nearly 2,000 large corporate and middle-market loans from the US, Canada, and Australia using the NPV approach. This analysis points to large business benefits for bank-

ing institutions that wish to improve the way they price and structure commercial loans. For large corporate loans in the $25 million to $200 million range, our analysis has shown NPV gains to range anywhere from $5,000 to $50,000 per loan. For the middle-market segment, the business case foundation rests more on the leverage provided by a portfolio of a large number of transactions. Again, analyzing samples of upper middle market loans ranging in size from $1 million to $10 million, we have seen NPV gains between $1,000 and $10,000.

The contribution to shareholder value can be substantial. Assume a reasonably sized middle market portfolio of 15,000 loans averaging about $1.5 million each, for a portfolio with about $22 billion in outstandings. Over a renewal cycle of maybe two and one-half years, if the bank could capture maybe $3,000 in extra NPV per loan for, say, one-third of the portfolio, the shareholder value gains would be about $15 million. This doesn't include expanded market share gains or gains from securitization. For a larger portfolio like those of the largest commercial banks in the US or Canada, the value contribution could be substantially larger.

The direct and indirect business case outlined above focuses primarily on the benefits of NPV analysis that can be captured during origination activities. Linking the importance of loan structure to portfolio management and value-at-risk analysis provides more benefits that are potentially quite interesting and will be discussed in a follow-up article.

IMPLEMENTATION ISSUES

NPV analysis measures the complicated interplay of the structural elements and pricing components of loans. With this information, RMs no longer need to play a passive role, providing limited options to borrowers. They are able to present and discuss a broader range of options with the customer. This expanded menu of loan structures provides ways to satisfy customer needs and help lenders structure and manage risk more efficiently.

To implement this new way of negotiating, a bank must look at critical business decision processes and technology issues. These include how to educate both RMs and customers, how to undertake the NPV analysis, and how origination decisions will link to risk-reward-driven incentive structures.

Technology issues include things like integrating decision support to existing lender workbenches, whether to choose local or centralized analytic processing, and how to link the decision support tool to middle-office data-warehousing initiatives. For the most part, these issues are beyond the scope of this article. To focus discussion of the problem, we recommend a four-quadrant approach to thinking about implementation strategies *(Exhibit 5)*.

If a bank wants to start slowly, with limited technology investment, it can take a centralized approach to the analysis in the form of a pricing and structuring desk (bottom-left quadrant). As loans are analyzed using the NPV approach, the loan data and structural information is entered and captured to support portfolio analysis, without investing in a substantial link to existing mainframe technology. This desk approach is more amenable to the large corporate market and could be directly integrated into the syndications operation.

Implementation options that require a more integrated technology effort are more expensive.

Alternatively, banks with RMs more regionally dispersed, for example, the middle-market operations in a superregional bank, could centralize the analytic process while decentralizing decisions about loan structure and pricing. RMs would have the freedom to run what-if scenarios that lead to profitable deals (bottom-right quadrant). At this level, you still can capture loan data and the NPV analysis without significant technology integration.

Implementation options that require a more integrated technology effort are more expensive (the upper two quadrants). The focus here is on leveraging the broader MIS benefits of NPV analysis and linking to other risk-management efforts like portfolio management, etc. In general, many banks are currently undertaking fairly substantial information technology investments. Capabilities like lender workbenches and data warehousing must be linked to the increasingly

EXHIBIT 5
Implementation Choices for RM Decision Support: The Effect on Cost

	CENTRALIZED PROCESS	DECENTRALIZED PROCESS
INTEGRATED TECHNOLOGY	$$$$ • Link/redesign of mainframe legacy systems • Focus on renewals or centralized pricing desk	$$$$ • Link/redesign of mainframe legacy systems • Focus on origination and RM-level analysis • Distributed processing
STAND-ALONE TECHNOLOGY	$$ • Data capture over time • Focus on renewals or a centralized pricing desk • RMs call 1-800-"loan structure" to analyze deal	$$$ • Data capture over time • Focus on origination and RM-level analysis

sophisticated analytic models that will drive future incentives and decisions. *Taking an integrated approach is the only way to achieve the full business benefits of these technologies.*

IT'S IMPORTANT TO ANALYZE THE TOTAL LOAN PACKAGE

The NPV approach described above analyzes the *total loan package*, including structure and price. This opens up the possibility for earning interesting arbitrage profits and expanding market share by leveraging superior knowledge of the subtle value of structure. As with most improvements in analytic technology that take advantage of market inefficiencies, the gains typically accrue to institutions that leverage the technology earlier in the process. At the other extreme, as competition and liquidity continues to expand, institutions that are not prepared face the potential for even greater adverse selection to higher credit risk and inferior structure in the deals they originate.

Our tests with random samples of large corporate and middle-market loans indicate that the potential gains can be substantial. For a large portfolio of loans, the added economic value can reach several tens of millions of dollars over a renewal cycle. To make these gains real, the new analytics must be applied by RMs in an intelligent fashion. To support this effort, banks need improved information and new business processes to support better analytic decisions. In addition, both RMs and commercial loan customers must be educated to understand and leverage the value of loan structure.

NOTES

[1]By structure, we mean all of the features of a loan other than price narrowly defined. Thus, structure includes the loan's term, type (term vs. revolver), amount, amortization of principal, covenants, collateral requirements, repayment rights, and aspects of pricing such as the mix of spread and fees and the nature of any pricing grids.

[2]For an earlier discussion on the hidden value inherent in structure and the importance of measuring embedded optionality, see Elliot Asarnow, "Measuring the Hidden Risks in Corporate Loans," *Commercial Lending Review* (Winter 1994-95): 24, and Bruce G. Stevenson, "The Intrinsic Value of a Commercial Loan: Understanding Option Pricing," *Commercial Lending Review* (Fall 96): 4.

[3]Astute pricing and structuring of loans presupposes that the lender has a solid risk rating system.

[4]More specifically, the successful banker will be able to evaluate price/structure trade-offs better than borrowers and competing bankers.

[5]Most pricing models focus on these three cost components, abstracting from loan structures and embedded options. Yet loan optionality, dominated by prepayment, tends to be "in the money" to the borrower. Thus, structural features can account for substantial costs not recognized by most of the pricing models now used in banks.

[6]We use the term RAROC broadly to denote a class of

models that look at risk-reward analysis; incorporate a view of the loan's income, expected losses, and some measure of operating costs; and then allocate economic capital in some way to define a percentage return on the allocated capital.

[7]RAROC systems have been helpful over recent years in providing an important first step toward proper risk-adjusted incentives, which were completely lacking. RAROC moves the accounting measures of profit and value much closer to the economic concepts.

[8]The CAPM, multi-factor CAPM, and APT models for equities tie pricing to an asset's covariance with a broad market portfolio. For an accessible explanation, see any basic finance text, such as, Frank J. Fabozzi, Franco Modigliani, and Michael G. Ferri, Foundations of Financial Markets and Institutions (Englewood Cliffs, New Jersey: Prentice-Hall, Inc., 1994): 261-85. The seminal sources include William F. Sharpe, "Capital Asset Prices: A Theory of Market Equilibrium Under Conditions of Risk," Journal of Finance (September 1964): 425-42 for CAPM; Robert C. Merton, "An Intertemporal Capital Asset Pricing Model," Econometrica (September 1973): 867-888 for multi-factor CAPM; and Stephen A. Ross, "The Arbitrage Theory of Capital Asset Pricing," Journal of Economic Theory (December 1976): 342-63 for APT.

[9]The actual estimation process involves more steps since market prices include options costs as well as cost of carry. The process seeks to determine par credit spreads for one-year option-free term loans. We don't actually observe these elementary term loans in the market, so we must impute their prices from the more complex loans that trade. The imputation process involves iterating between market prices and LAS. We start by calibrating the LAS to initial judgmental values (or last period's values) of the elementary prices. We then use the LAS to back out estimates of the effects of structure on current benchmark loan prices. By removing these valuations of structure, we then extract from the market a second estimate of the elementary prices and so on.

[10]The LAS model includes an option-adjusted and term-adjusted RAROC module, which was used to undertake these calculations. This approach is consistent with the NPV approach and solves two of the primary problems associated with current RAROC models, as was pointed out above. We use the acronym, OARRAC for option-adjusted return on risk-adjusted capital to denote the LAS RAROC calculation.

[11]The analysis required to support loan securitization and trading requires that a bank undertake NPV analysis during the life of the loan, not just at origination.

[12]KPMG's risk solutions practice is a cosponsor of CreditMetrics™. The LAS application has the potential to support value-at-risk analysis and credit derivative pricing and structuring in addition to origination support.