*Investment professionals have long used modern portfolio theory to reduce risk through diversification. In this article, Bruce G. Stevenson and Michael W. Fadil optimize an actual portfolio of 1,400 syndicated loans to show how MPT can work for commercial loans.*

# Modern Portfolio Theory: Can It Work for Commercial Loans?

BRUCE G. STEVENSON
MICHAEL W. FADIL

MODERN PORTFOLIO THEORY (MPT) is the dominant theoretical framework for investment management. First pioneered by Harry Markowitz, MPT holds that risk and return are positively related within investment portfolios and that, in such portfolios, the risk associated with a given level of return can be reduced or minimized through diversification of the underlying investments. Conversely, it is possible to maximize returns through concentration of portfolio holdings in one or two investments.

Although MPT has been the key concept around which many equity and bond portfolios have been managed for several decades, it has rarely been applied to commercial loans. Recently, Terry Gollinger and John Morgan[1] of Mellon Bank demonstrated that it is possible to optimize a portfolio of middle-market commercial loans using market pricing data for returns and probabilities of obligor default for risk. However, this discipline of portfolio management remains a novel approach for many commercial bankers.

Bruce G. Stevenson is vice president and director, portfolio valuation, at Loan Pricing Corporation, New York. Michael W. Fadil is vice president, corporate credit administration, at Fleet Financial Group, Providence, Rhode Island.

In this paper, we will demonstrate the following:

- Commercial loan portfolios can be readily optimized.
- Optimization is a very powerful tool for reducing the risk in commercial loan portfolios while retaining satisfactory returns.
- The banker's dilemma of "loan volume versus credit quality" does not have to be a dichotomous choice if portfolio management tools, such as optimization, are used.

## The Efficient Frontier

Within MPT, the Markowitz model for stocks and bonds holds that an investment portfolio is optimized by minimizing the risk of the portfolio, as measured by the variability of security returns, given a fixed return for the portfolio. The model solves for the optimum mix of individual securities (that is, percentages) in the portfolio. An "efficient frontier" is created by connecting the points between the minimum risk portfolio and the maximum return portfolio.

*Exhibit 1* presents the efficient frontier. Point A represents the minimum return portfolio and point B describes the maximum return portfolio. Each of these points typically is represented by a portfolio dominated by a single security.

Point C is especially interesting because it represents that portfolio with minimum risk, although with a higher return than point A. This phenomenon is attributable to diversification benefits associated with holding multiple investments with low or negative correlations with each other. The benefits of diversification are measured through a matrix of correlation coefficients between each pair of securities.

Individual portfolios may lie to the right of the efficient frontier but not to the left. For portfolios to the right of the frontier it is possible to move toward the frontier or onto it through "portfolio rebalancing" (that is, changing the mix of the underlying securities).

## Application of MPT to Commercial Loan Portfolios

Application of the Markowitz model to portfolios of commercial loans is not as straightforward as it is for portfolios of stocks or bonds.

*Returns on loans*

First, returns on loan portfolios are not widely publicized. Only recently have return indices for commercial loans been created, and no such index has the historical return series by which to calculate the necessary correlations to create the efficient frontier.

Loan returns are asymmetric, with almost no potential for upside gain on loans (except for those few loans that may be bought below par in secondary markets) and substantial downside loss through deterioration in the credit quality of the borrower. In very few

Exhibit 1

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**Generalized View of Efficient Frontier
from Markowitz Model of Investment Portfolios**

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RETURN



RISK

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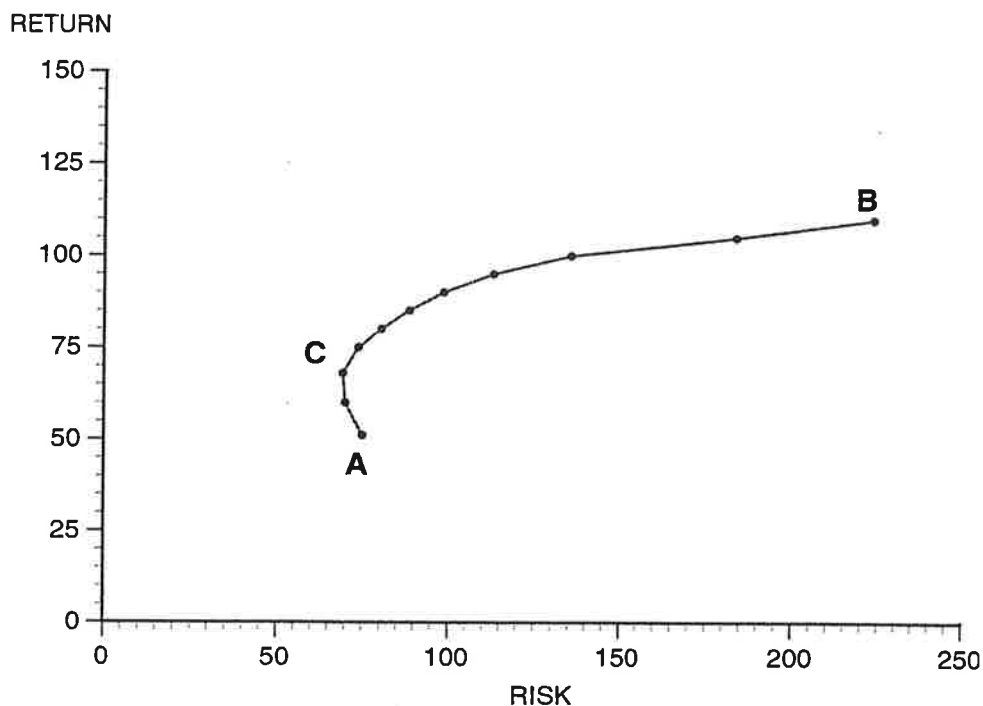
instances, performance-based pricing may permit increased compensation to the lender if a borrower's credit quality deteriorates, but most loan agreements do not permit higher compensation for such deterioration. In addition (and obviously), when a borrower defaults accrued interest is reversed, charge-offs may occur, new payments are applied to principal, and other workout costs (including legal expenses) are incurred.

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*Loan returns are asymmetric, with almost
no potential for upside gain on loans.*

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One exception to the lack of public information on loan returns is the broadly syndicated loan market (BSLM). These large loans, made generally to commercial and industrial firms, are originated by syndicates of banks that individually hold portions of the loans in their portfolios.

Some pieces of these loans may be traded in the small secondary market for commercial loans.

Pricing characteristics in the BSLM are tracked by Loan Pricing Corporation (LPC) in its DealScan database. These loans, typically priced as floating-rate instruments with the London Interbank Offer Rate (Libor) as the base rate, have returns that are expressed as spreads over Libor. Annual fees and up-front fees (as amortized over the life of the loan) are added to the contractual spread over Libor to create an "all-in spread" (AIS).

### Risk of loans

A second limitation to the widespread use of MPT for loans is the scant public information on the risk characteristics of commercial loans. For banks that originate commercial loans and hold them on their own balance sheets (so-called originate-and-hold investors), the volatility of returns is directly related to the risk that principal and interest payments are interrupted due to financial default of the borrower. Although some banks have tied their internal rating systems to measures of default risk, there is not a common standard of default risk for the banking industry.

Again, the BSLM is an exception. Many such credits have public ratings since the loan obligors have also borrowed in the public bond markets. Bond ratings can be tied to default probabilities since several of the rating agencies have published studies on the long-term default risk of corporate bonds. These default probabilities can be applied as risk measures for broadly syndicated loans.

### Correlations

A third—and perhaps the most difficult—aspect of applying MPT to commercial loans is understanding and quantifying the correlation of returns between classes of loans. Just as there is little history on the returns on loans, there are few data on how those returns are correlated.

Since most investors in commercial loans (that is, banks) are originate-and-hold investors, the correlation in returns can be proxied by correlations in the risk of default. We believe that the relationship of business failure risk[2] across 33 groups of related industries[3] is the best source of correlations for optimization of a commercial loan portfolio. We have analyzed these data on annual business failure rates by industry from 1984 to 1992 and have used the results as proxies for the correlations of returns by industry.

## An Efficient Frontier for Commercial Loans

We have optimized a portfolio of broadly syndicated loans represented by loans in the LPC DealScan database closed between January 1992 and March 1994 for which there was a senior public debt rating and an all-in spread (roughly 1,400 facilities) (*Exhibit 2*). Return is measured as the AIS over Libor minus the losses (in basis points) expected given the pub-

Exhibit 2

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**Efficient Frontier for the Broadly Syndicated Loan Market**

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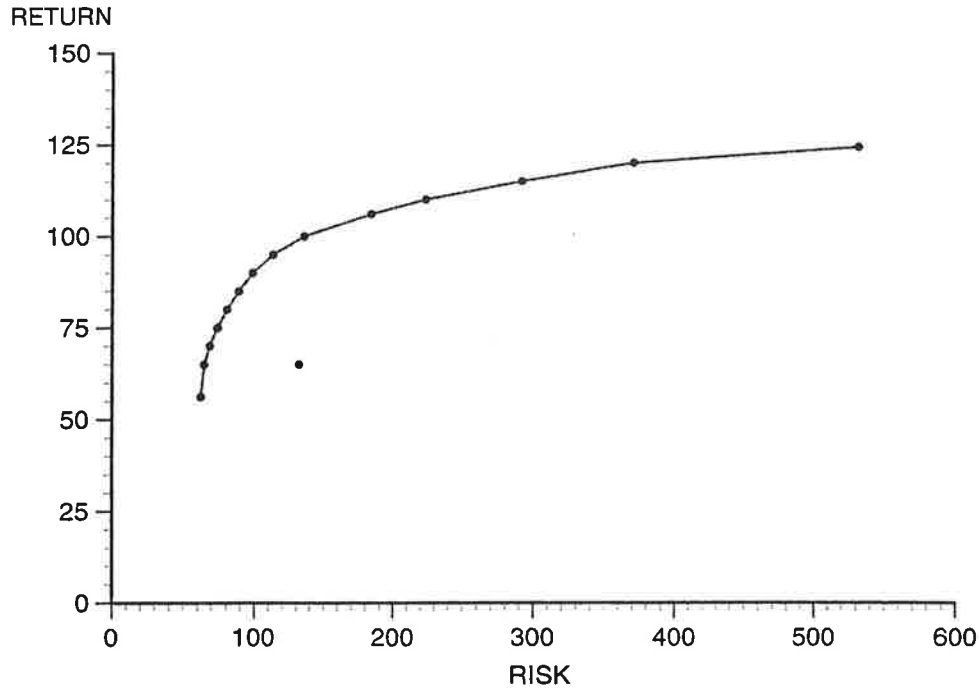
RETURN



*Note: Dot denotes actual position of broadly syndicated loan market.*

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lic rating of the borrower. Risk is measured as the volatility of losses given the public rating.[4] The dot in *Exhibit 2* denotes the position of the BSLM in risk/return space.

The efficient frontier shows that there is a narrow portion of risk (50 to 150 bp on the x-axis) that accounts for most of the variability in return (55 to 100 bp on the y-axis). This result implies that an investor in the BSLM can substantially increase portfolio return without incurring dramatically more risk. Put differently, a banker does not have to go down market to boost returns; instead, the increased return comes from shifting the composition of the portfolio of existing borrowers.

This point is further supported by the distance between the actual risk/return position of the BSLM as it exists today and the efficient frontier. If a bank that had a random representation of the BSLM in its portfolio wanted to increase its return for the same level of risk, it could shift the composition of its existing borrowers so that the dot moved directly

parallel to the y-axis from its present position to the efficient frontier. In this case the AIS would nearly double (58 bp to 98 bp).

Conversely, the bank could dramatically reduce its risk, while retaining the same return, by moving its portfolio from the dot to the frontier in a line parallel to the x-axis. This would have the impact of nearly halving the loss volatility (111 bp to 65 bp). Of course, such a move would imply a significant drop in the risk of a lending crisis, which typically is the source of dramatic losses to a bank.

> *A banker does not have to go down market to boost returns; instead, the increased return comes from shifting the composition of the portfolio of existing borrowers.*

*Exhibit 2* also shows that, in the efficient frontier, there is a long tail to the right, which implies a significant increase in risk with very little gain in return. This tail indicates that the BSLM prices for high-risk inefficiently—it does not reward banks that do go down market to get increased nominal yield—and that banks that take this increased risk are generally not compensated for it.

## MPT as a Portfolio Management Tool

We have investigated two recent approaches to commercial loan portfolio management within the context of MPT: risk-adjusted pricing and concentration limits (*Exhibit 3*). Risk-adjusted pricing is a practice in which capital is allocated to individual loans or lending relationships and pricing is set to deliver a target return on (risk-adjusted) equity (ROE). Concentration limits are simple caps on the exposure to a single borrower or industry that attempt to limit portfolio losses in credit downturns.

In *Exhibit 3*, we display efficient frontiers in which (a) returns on loans in the BSLM are constrained to meet 15% ROE or (b) a concentration limit of 7.5% is set for any single industry. Several conclusions are apparent:

- The long tail of risk without adequate returns has been eliminated. In other words, both risk-adjusted pricing and concentration limits, *in the context of portfolio optimization,* eliminate the poorly priced transactions that do not build real value and which likely contribute to significant waves of default or lending crises.
- The frontier for risk-adjusted pricing is slightly higher on the y-axis and somewhat more convex (that is, curved to the left) than that for concentration limits. Thus, risk-adjusted pricing is a more dynamic and profitable management tool than concentration limits within the framework of MPT.
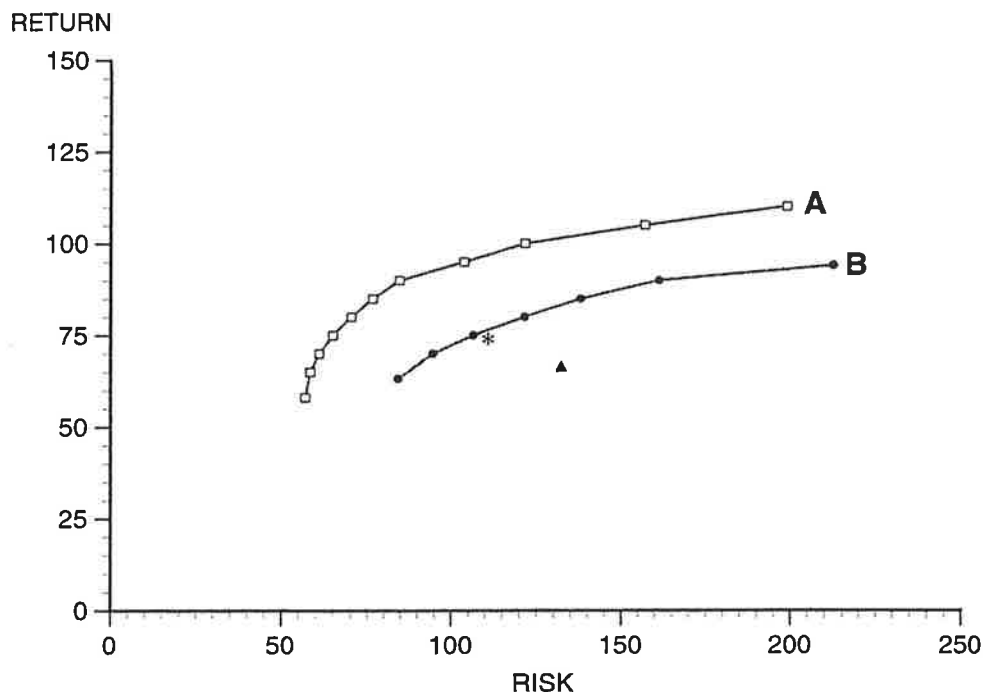
Exhibit 3

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## Efficient Frontiers for the Broadly Syndicated Loan Market

*With risk-adjusted pricing (A) and concentration limits (B)
as portfolio management tools*

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RETURN



RISK

*Note: Asterisk denotes position of portfolio under risk-adjusted pricing; triangle indicates portfolio under concentration limits.*

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- Applying risk-adjusted pricing shifts the position of the BSLM in the desired direction (to the upper left in *Exhibit 3*). The actual position of the portfolio as constrained by 7.5% industry limits is no different from the unconstrained portfolio (because this strategy only seeks to limit exposure to loss). Thus, risk-adjusted pricing, as an *offensive* portfolio strategy, does improve the risk/return characteristics of commercial loan portfolios while concentration limits, which are a *defensive* strategy, only constrain worst-case losses.

Exhibit 4

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**Impact of Portfolio Management Practices on Loan Volume
in the Broadly Syndicated Loan Market**

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|---|---|
| Total broadly syndicated loan market (BSLM) | $477.4B |
| BSLM loans yielding 15% ROE | 393.8 |
| BSLM loans with 7.5% limit on industries | 384.1 |

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## Volume versus Credit Quality

In recent decades, commercial bankers have found that lending crises
have imposed high volatility on their earnings. Often such lending crises
follow rapid increases in loan volume. This correlation suggests a trade-
off between portfolio growth and portfolio performance. "Volume versus
credit quality" seems like a Hobson's choice to many bankers, offering no
real alternative in terms of portfolio performance.

We disagree. MPT can, and does, allow commercial bankers to
achieve portfolio growth, credit quality, and profitability, particularly
if they adopt a long-term perspective. For example, we outline in
*Exhibit 4* the small reductions in volume that occur in the BSLM if
risk-adjusted pricing or concentration limits are adopted. Since both
practices significantly reduce risk (16% and 18% drop in loss volatili-
ty, respectively), the gain in risk reduction and its beneficial impact
on profitability more than offset the loss of nominal earnings associat-
ed with a drop in loan volume.

## MPT to Reduce Risk, Enhance Returns

Adoption of MPT as a portfolio management tool can significantly
enhance a bank's ability to reduce risk and enhance returns on com-
mercial loans. When coupled with other portfolio management tools,
such as risk-adjusted pricing and concentration limits, MPT can
deliver significant volumes of high-quality loans that provide satis-
factory profitability.

## Notes

[1]Gollinger, T.L. and J.B. Morgan, "Calculation of the Efficient Frontier for a
Commercial Loan Portfolio," *The Journal of Portfolio Management* (Winter 1993):
39-46.

[2]Dun & Bradstreet *Business Failure Record.*

[3]The 33 groups of related industries follow: farming/agriculture/food production;
food distribution; petroleum/gas/coal; utilities/energy distribution; metals (except
precious metals); jewelry and precious metals; construction/contractors/commer-
cial real estate; apparel and textiles; wood and paper products; printing and
publishing; basic chemicals; pharmaceuticals and personal care products; plas-

tics/ceramics/rubber products; national defense; computers and electronics; passenger transportation; freight transportation; tourism and entertainment; communications; health care; home furnishings and consumer durables; government and public administration; insurance; banking and finance; other personal services; other business services; industrial machinery; private households; legal services; education and related services; other manufacturing, wholesaling, and retailing; conglomerates; all other, nonclassified.

[4]The point plotted on the x-axis is the 98th percentile of simulated losses given the default risk associated with the public rating and loss severity associated with nonaccruing commercial loans.