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SPDA spread management in a rising rate environment

by Prakash Shimpi and Joe Koltisko

This case study in derivatives was presented at the Orlando April spring meeting in Session 40, "Are We Prepared for Interest Rates to Rise Again?" This and other case studies will be presented at the SOA seminar, "Building Blocks of Derivatives," June 28 in Boston and June 30 in Chicago. If readers are interested in seeing more investment case studies in The Actuary, please drop a note to the editor at the Society office.

Situation:

A life insurance company offers a Single Premium Deferred Annuity (SPDA) policy with a crediting rate that closely tracks the 5-year Treasury rate. The company manages its crediting rate to remain competitive while earning a target spread over the portfolio rate. In the prior two years, the target spread had been easy to achieve since the 5-year Treasury rate had fallen significantly. The portfolio rate, although declining, was well over the sum of the crediting rate and target spread. The company was concerned that the minimum guaranteed rate that it had to pay on some of its policies would squeeze profits, but this is no longer a major concern since interest rates have started to rise.

To match the SPDA liability, the company invests in fixed-income securities, particularly high quality corporate bonds and mortgage-backed securities. It manages the portfolio on the basis of information generated by multi-scenario cash flow testing.

Concern:

In the course of the cash flow testing, the company has identified potential losses in a rising interest rate environment. As interest rates rise, the portfolio average rate will begin to increase but will lag behind the increase in the 5-year Treasury rate.

To remain competitive, the company would have to sharply increase its crediting rate. By doing so, however, the target spread is not achievable. Crediting a rate below the 5-year Treasury rate would likely cause excess lapses that would have to be paid by liquidating assets at low market values.

The higher reinvestment rate available in the fixed-income markets would not help the company as much as it would like, since the company is not generating excess cash, either from capital gains or new business.

Furthermore, just when the company would like to shorten the duration of its investments, the mortgage-backed securities are expected to experience extension, i.e., mortgage prepayments slow down due to fewer refinancings.

Now that interest rates have increased sharply in the first few months of 1994, the company has decided to seek a solution that would allow it to credit a higher rate and maintain its spread.

Solution:

The insurance company enters into a Constant Maturity Treasury (CMT) Swap for asset/liability management. The insurance company contracts to make a fixed payment to a bank in exchange for a payment based on the then current 5-year Treasury rate. The amount of the payment is based on a number known as the "notional principal." The notional principal is only used for calculating the amount of the payments and is not actually paid by one party to the other. The swap contract specifies the periodicity of the payments, e.g., every six months, and the term of the agreement ("tenor"), e.g., three years.

From the insurance company's point of view, the transaction is as follows:

Earn on investment portfolio:	+ Fixed swap rate + Spread
Pay on swap:	– Fixed swap rate
Receive on swap:	+ <u>Floating 5-year CMT rate</u>
Result: Earn on portfolio:	+ Floating 5-year CMT rate + Spread
Pay Policyholder:	– <u>Floating 5-year CMT rate</u>
Earn on Product:	+ Spread

(Figure 1 illustrates the exchange of cash flows.)

By entering into the swap, the insurance company can lock in a spread. If the spread exceeds the target spread, then the insurance company's objectives are met as long as the swap is in place. If the spread is less than the target spread, then the company has effectively minimized the risk of the spread falling even further as interest rates rise.

In addition to the swap, the insurance company could purchase an Interest Rate Floor to cover the minimum

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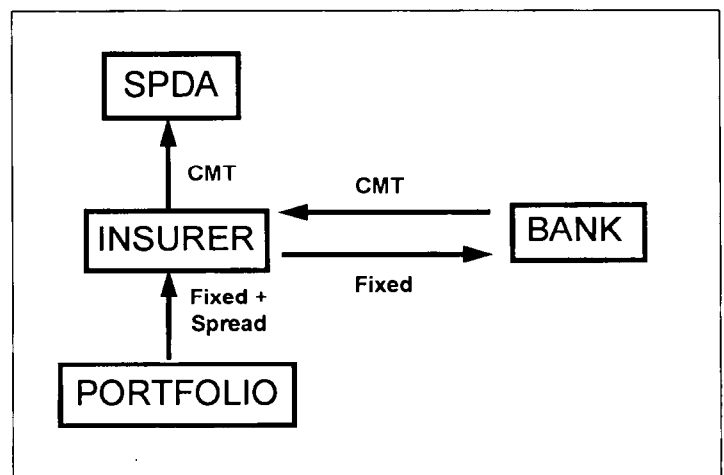


Figure 1

Case study in derivatives (continued from page 7)

crediting rate guaranteed to policyholders. The floor would be designed to pay the guaranteed rate if the 5-year CMT were to fall below the guaranteed rate.

Other derivative structures are possible to meet the insurer's needs. For example, the swap payments could be designed to pay only in those interest rate environments where interest

rates increase by more than a predetermined amount in any 6-month period, e.g., pay only if rates rise by more than 25 basis points. This is similar to buying a layer of reinsurance.

If interest rate risk is viewed as the "catastrophic risk" for life insurance companies, then this case study illustrates how derivatives can be used to reinsure the risk.

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RESEARCH CORNER

Several new projects for which proposals were solicited this winter are causing a flurry of activities this spring in the Research Department. Project oversight groups evaluated proposals and recommended letters of agreement for these research activities:

- The two projects to define the necessary research relating to dynamic solvency testing were jointly awarded to Allan Brender, William M. Mercer Ltd., and Donna Claire, Claire Thinking Inc. They plan to have a report by mid-summer 1994.
- A dynamic solvency testing project on the historical perspective was awarded to Robert Fillingham, Fillingham & Co. A final report is due early summer 1994.
- The project on the analysis of health carrier insolvencies was awarded to James Ross and Criss Woodruff of Radford University.

Work on this project began mid-May, with analysis of data scheduled for July and report preparation occurring in late summer. The final report is planned for mid-September 1994.

- Two proposals have been funded for the "Methodology to Deal with Dependencies on Multi-Life Risks" research project. Jacques Carriere, University of Manitoba, is expected to collect and analyze data. Edward (Jed) Frees and Emiliano Valdez, University of Wisconsin, plan to prepare a literature review, construct a mathematical model, run statistical tests, and develop numerical illustrations. The researchers plan to have final reports by fall 1994.

The results of Arthur Warga's research on bond pricing are published in the following articles: "Bond Returns, Liquidity, and Missing Data," *Journal of Financial Quantitative Analysis*, Vol. 27, No. 4, December 1992, pp. 605-617, and "Corporate Bond Valuation in the Dealer and Exchange Markets," *Contingencies*, September/October 1992, pp. 50-56.

The preliminary report on direct marketing persistency appears in the spring issue of *News Direct*, the

newsletter of the Nontraditional Marketing Section. A report on direct marketing mortality is being prepared and will appear in an upcoming issue.

Preliminary results of the "Long Term Bond Yields of Life Companies with Junk Bond Portfolios" research project were presented during a session at the Society's spring meeting in Orlando. A report on the "Large Claims Data Base" research project and additional analysis of the 1986-89 credit risk data also were presented at the Orlando meeting.

The Committee on Actuarial Principles has received letters in response to the exposure draft on "Reserve Principles for Life Risks." On April 15, the committee conducted a joint meeting with the Casualty Actuarial Society's corresponding committee to discuss the possible joint development of a general actuarial principles document.

The Ph.D. Grants Task Force has reviewed applicants for the 1994-95 Ph.D. grants competition. Grants awarded this year will be announced by June 15, 1994.