LIFE PRACTICE NOTE 1995–6
December 1995

Modeling Bond Default Risk

Introduction

This practice note was prepared by a work group organized by the Committee on Life Insurance Financial Reporting of the American Academy of Actuaries. The work group was charged with developing a description of some of the current practices used by valuation actuaries in the United States. This work group was originally formed in 1992 and issued the first set of Life Practice Notes that year; changes have been made to this set of practice notes on an annual basis to reflect additional information on current practices.

The practice notes represent a description of practices believed by the work group to be commonly employed by actuaries in the United States in 1995. The purpose of the practice notes is to assist actuaries who are faced with the requirement of adequacy testing by supplying examples of some of the common approaches to this work. However, no representation of completeness is made; other approaches may also be in common use. It should be recognized that the information contained in the practice notes provides guidance, but is not a definitive statement as to what constitutes generally accepted practice in this area. Moreover, these practice notes are based upon the model Standard Valuation Law of the National Association of Insurance Commissioners (NAIC). To the extent that the laws of a particular state differ from the NAIC model, practices described in these practice notes may not be appropriate for actuarial practice in that state. This practice note has not been promulgated by the Actuarial Standards Board, nor is it binding on any actuary.

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Comments are welcome as to the appropriateness of the practice notes, desirability of annual updating, validity of substantive disagreements, etc. Comments should be sent to Donna R. Claire at her Directory address.

Q. What is *asset risk?*

A. *Asset risk*, as defined in Actuarial Standard of Practice (ASOP) No. 22, *Statutory Statements of Opinion Based on Asset Adequacy Analysis by Appointed Actuaries for Life or Health Insurers*, is "the risk that the amount or timing of items of cash flow connected with assets will differ from expectations or assumptions for reasons other than a change in investment rates of return." This risk, which includes default risk, is commonly referred to as *C-1 risk*.

Q. What are the current practices used in modeling default risk?

A. C-1 bond default risk has been most thoroughly evaluated in relation to risk-based capital needs. The analysis often takes the form of cash flow testing where the capital required to protect a company from threats to financial security under severely adverse conditions is developed. C-1 bond default risk has traditionally been evaluated independently of other forms of insurance risk.

In contrast, cash flow testing for reserve adequacy assessment usually makes provision for all forms of risk, with the primary emphasis on investment-rate-of-return risk (also known as *C-3 risk*). The testing measures asset and liability cash flow variations resulting from changes in interest rate environments. However, other insurance risk assumptions, including default risks, are sometimes held static over the modeling period.

One current practice of incorporating bond defaults into asset adequacy analysis results in a constant percentage reduction in the level of investment income. This can be accomplished by either reducing the asset value of all assets within a given asset quality class by the expected default rate for that period, with adjustment for residual values; or by subtracting a certain number of basis points from the amount of investment income each year. The default

assumptions are based on published historical default studies or company experience, and usually average the experience over a number of years. More sophisticated modeling varies the default assumptions by the rating quality of the bonds.

Q. What are the limitations with the current practice mentioned above?

A. As stated above, cash flow testing for asset adequacy analysis emphasizes exposure to interest rate risk. Asset and liability assumptions determine how policyholders, insurers, and borrowers vary their actions in response to changing interest rates. While there are other influences that affect these actions, cash flow testing under multiple interest rate scenarios can provide a sufficient test for reserve adequacy with respect to the C-3 form of risk.

Default risk exposure, however, is more correlated to general economic conditions than to interest rate levels. Default risk usually is correlated to interest rate fluctuations only to the extent that more general economic conditions have correlation to interest rates. This correlation is not robust, and actuaries have, therefore, not generally attempted to vary default experience within interest rate scenarios, even though some cash flow software provides such a mechanism. Cash flow models also have generally not integrated economic conditions with interest rate scenarios. Actuaries have typically built default risk into cash flow asset adequacy testing through static default experience assumptions.

Factors other than economic-related default fluctuations may also affect an asset portfolio's exposure to default risk. These factors are usually related to the specific makeup of the assets supporting the liabilities. These factors include the number of assets, the size of the individual issues, and the concentrations of assets with specific characteristics. For example, if a significant percentage of the portfolio's value is maintained in several very large issues, the default risk is greater than a portfolio of equal-sized assets. Similarly, a portfolio of 100 bonds of equal size is usually more risky than an equal-sized 600-bond portfolio. These types of variations in risk typically are not captured by applying a default loss factor ratably across all the assets in the portfolio, even if the loss assumptions vary with economic conditions.

Q. What types of considerations generally are reviewed in developing default experience assumptions?

A. Some actuaries do not develop specific company assumptions, but instead take an average charge of 10% of the AVR charges for each asset each year as a proxy for default rates.

In performing asset adequacy analysis, the appointed actuary generally considers reviewing historical bond default experience to develop average experience assumptions. The review could consider default experience over a 10- to 20-year period along with more recent experience. Company default experience may be valuable to study if the portfolio is large enough, especially for private placement bond experience.

A Society of Actuaries study, *1986–89 Credit Risk Loss Experience: Commercial Mortgage Loans and Private Placement Bonds* (published in October 1993), gives information on the credit risk for commercial mortgages and private placements. Information from this study could be useful in developing default risk charges.

Consideration may also be given to potential changes in future experience relative to past experience. Variations in annual rates of default and loss severity may be noted, keeping in mind that the magnitude of these variations may likely differ by quality ratings. From these reviews, the actuary may develop *average* default experience assumptions for use in cash flow testing. A number of actuaries do use different default assumptions, depending on the actual quality rating of the asset classes.

Q. Are there other specific considerations in modeling defaults?

A. Current practice and state-of-the-art cash flow software generally do not allow for the full integration of interest rate risk and default risk. The software also typically does not provide the analytical tools required to evaluate how default risk will vary by economic conditions or how default risk varies by specific makeup of the portfolio (number of issuers, size concentrations, publics versus privates, etc.).

The appointed actuary usually will have an understanding of how default experience of the modeled asset portfolio can deviate due to its specific characteristics. One approach to develop this understanding is to use a default model that permits several variations in asset makeup (e.g., quality, size, and concentration).

Q. Is sensitivity testing done on the C-1 risk?

A. A survey of what actuaries did for year-end 1992 testing showed that 30% did sensitivity testing on the C-1 risk. The results of this testing would probably be more significant for companies with lower-quality assets.

Q. Why are the bond default risks tested, since the risk-based capital provision and the asset valuation reserve cover default risk?

A. The risk-based capital formula determines an appropriate minimum level of surplus. Since the asset adequacy testing is for reserve adequacy, not company solvency, the surplus does not impact the testing. However, the actuary can consider the asset valuation reserve (AVR) in determining the reserves needed to cover defaults, since the AVR is a reserve.

Q. What are possible methods of testing for bond default risk in an asset adequacy analysis?

A. Using the knowledge gained from an historical review of default rates under changing economic conditions and from a review of potential default variations due to portfolio characteristics, the appointed actuary typically will have gained insight into the potential annual fluctuation in default experience, as well as fluctuations over a successive period of years. As stated above, current software technology does not readily permit default risk assessment much beyond a static reduction in yield, certainly not a full integration of default risk with interest rate risk. However, the appointed actuary may want to take a more rigorous approach to default risk assessment than merely reducing the yield by the *average* default loss.

Some actuaries test for asset adequacy using the static approach within interest rate scenario cash flow testing. The static default assumptions (where default losses are level over the modeling period for a specific asset quality and grade) can consider assumptions developed from at least three experience period reviews: a 10- to 20-year historical analysis, a more recent historical review (3 to 5 years), and a short-term *best estimate* set of assumptions looking forward. The assumptions provided from this initial analysis for the static approach will provide a *base level* if further default testing is necessary.

The actuary may wish to examine the effect on reserve adequacy of possible fluctuations (due to economic changes or portfolio specific characteristics) around the expected default rate. This type of assessment is more important if the base level testing indicates reserve levels at or nearing inadequacy. The approach to this second level of testing is not straightforward using currently available software. One kind of test that could be performed under the static approach would be to use a default assumption that deviates from the expected value by, for example, one standard deviation. Such a test typically will allow the actuary to observe the sensitivity of results to the default assumption.

Q. Are there any other considerations in evaluating bond risk?

A. A number of actuaries evaluate the default risk of other bonds issued by the same issuer if such bonds constitute a significant percentage of the portfolio.

In addition to asset default risk, actuaries can consider obligation and investment-rate-of-return risk exposures.

Q. Where can additional sources of information on bond default be found?

A. The *Dynamic Financial Conditional Analysis Handbook* (Society of Actuaries, 1995), chapter 4, covers analysis of assets. The bibliography in that chapter gives specific references for bond defaults.