DYNAMIC FINANCIAL ANALYSIS in 4 Easy Steps

Dynamic Financial Analysis is more than just a buzz word in the property/ casualty actuarial community—many say it's the wave of the future. Ever wonder what the buzz is about?

By Glenn Meyers

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ACCORDING to Susan Szkoda, president of Szkoda Actuarial Services in Marietta, Ga., dynamic financial analysis (DFA) can be defined as "a process for analyzing the financial condition of an insurance entity." Writing in a five-part article that began in the May 1997 *Actuarial Review*, she went on to say that "financial condition refers to the ability of the entity's capital and surplus to adequately support future operations through a currently unknown future environment."

As property/casualty insurers intensify their interest in dynamic financial analysis, actuaries are looking at DFA as a new effective tool

they can use to set combined ratio targets by line of insurance. Given the right skills, the actuary can provide key input into an insurer's successful future business plans, however uncertain that future may seem.

Here is a four-step approach to setting those combined ratios, based on a hypothetical insurer.

The ABC Insurance Company is a multiline insurer. Its goal is to obtain an above-average return on equity by setting profitability targets for each of its underwriting divisions that reflect the cost of capital needed to support each division's contribution to the overall underwriting risk. ABC intends to exit any line of insurance that fails to meet its underwriting target.

While ABC's management recognizes the important role regulators and rating agencies play in evaluating the adequacy of an insurer's capital, it feels that controlling the insurer's risk, as measured by its statistical distribution of outcomes, provides a meaningful yardstick it can use to set profitability targets.

In addition, ABC's management wants to consider the following questions in making its decisions.

How long must capital be held? The underwriting results for the typical liability line of insurance are not known for several years. As long as there is uncertainty in the final result, some capital must be held. The profitability targets for each line of insurance should reflect the cost of holding capital until all claims are settled.

How much investment income is generated by the insurance operation? Capital held for the contingency of unusually high losses is also earning investment income. The profitability targets for each line of insurance should reflect the investment earnings generated by each line of business.

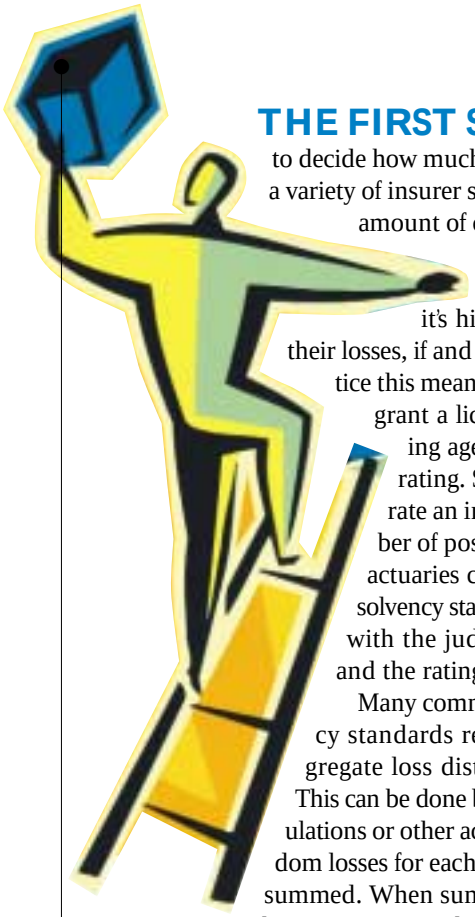
How closely correlated are the losses in the various lines of insurance? The textbook illustrations of the economic value of insurance often assume that insured accidents are independent events. Positive correlation increases the amount of capital needed and hence its cost. This cost should be reflected in the profitability targets for each line of insurance.

What is the effect of reinsurance? In place of raising capital, an insurer may rely on reinsurance to provide security for its ability to pay losses. The cost of reinsurance replaces part of the cost of capital. Profitability targets should reflect both the cost and benefit of reinsurance on each line of insurance.

The cost of financing an insurance company is defined to be the combined cost of capital and the transaction cost of reinsurance (i.e., the premium less the expected reinsurance recovery). The ABC Insurance Company wants to allocate its cost of financing back to its individual underwriting divisions.

Next, ABC will add this allocated cost of financing insurance to the expected losses and the other allocated expenses to obtain target combined ratios for each underwriting division in the company.

Following these actuarial steps can solve this problem. For actuaries who want all the technical details of how the process works, visit the Casualty Actuarial Society Web site at http://www.casact.org/pubs/forum/00sforum/meyers/. (This site includes an Excel spreadsheet with a numerical example illustrating the ideas presented in this article.) For those who prefer a less technical explanation, read on.



THE FIRST STEP in this analysis is to decide how much capital ABC needs under a variety of insurer strategies. In principle, the amount of capital an insurer needs is whatever it takes to convince policyholders that it's highly likely they'll recover their losses, if and when they occur. In practice this means persuading regulators to grant a license and convincing rating agencies to grant a desirable rating. Since a rating agency can't rate an insurer under a large number of possible operating strategies, actuaries can derive a mathematical solvency standard they hope will agree with the judgments of the regulators and the rating agencies.

Many common mathematical solvency standards require calculating an aggregate loss distribution for the insurer. This can be done by either Monte Carlo simulations or other actuarial methods. The random losses for each line of insurance must be summed. When summing the random losses, the actuary must take into account the correlation (i.e., a measure of how often bad things happen all at once) between the lines of insurance. An insurer with highly correlated lines of insurance needs more capital than an otherwise equivalent insurer with negligible correlation among its lines of insurance.

Once the insurer's aggregate loss distribution has been determined, an actuary can calculate how much capital an insurer needs to pass a selected solvency standard. Examples of the currently popular solvency standards include:

- probability of ruin (or equivalently the value at risk)
- standard deviation principle
- tail value at risk

The tail value at risk is a relatively new concept introduced by Philippe Artzner, Freddy Delbaen, Jean-Marc Eber, and David Heath in their paper, "Coherent Measures of Risk," which appeared in *Mathematical Finance*, Volume 9 (1999). It can be downloaded from the Web at http://www.math.ethz.ch/~delbaen/ftp/preprints/CoherentMF.pdf.

To calculate the tail value at risk, simply take the average of the top p% of losses, where p is a percentage selected by the analyst.

THE SECOND STEP in this analysis is to allocate the capital to the underwriting division—usually but not necessarily the line of business. Capital allocation has been a controversial subject among actuaries. As Chuck McClenahan, a principal with William Mercer in Chicago, once put it, "A policy written with a monoline automobile insurance company with $100 million of surplus is not as well protected as a policy written with a large multiline insurance company with $100 million allocated to its automobile line of insurance."

I agree with Chuck's statement. But I also agree with the idea of using capital allocation as an internal management tool that can relate an underwriting division's financial goal to the insurer's corporate financial goal. A capital allocation method is valid as long it leads to decisions that make economic sense.

ABC will stop writing the lines of insurance supported by a particular underwriting division if it doesn't expect the underwriting division to meet target rates of return on its allocated capital. ABC has to expect a rate of return on its capital that's at least as high with the underwriting division as it expects without the underwriting division.

It can be demonstrated mathematically that ABC will keep the underwriting division if its return on marginal capital is greater than or equal to ABC's overall target rate of return. When totaled, however, the sum of marginal capital for each underwriting division is inevitably less than the total capital of the corporation. This means that if the return on marginal capital for all underwriting divisions is equal to ABC's target rate of return, ABC will get less than its target return on its entire capital! While it may make economic sense for the target rate of return for a single underwriting division to have a target return on marginal capital equal to the insurer's overall target, ABC can't set the target for all underwriting divisions in this manner.

Within the limits prescribed above, ABC's management can arbitrarily set profitability targets that make economic sense. An important consideration in setting these targets is that management may want to treat its underwriting division heads "fairly." One way to do this is to allocate the insurer's capital in proportion to each underwriting division's marginal capital.

THE THIRD STEP in this analysis is to calculate the cost of capital needed to support the outstanding losses. The payments for outstanding losses are uncertain, so ABC needs to allocate capital to support the uncertainty in these payments. This means that the distribution of unpaid losses must be considered when deriving ABC's aggregate loss distribution.

When writing policies in the long-tailed lines of business, it's important to note that an insurer must allocate capital to support this action for several years into the future. To do this, the insurer needs to plan for the business it intends to write for several years into the future. As the insurer settles claims for a given set of policies, the uncertainty is reduced and the insurer can release its capital back to the owners. Since capital must be held longer for the long-tailed lines, the cost of capital will be higher for these lines.

Let's look at the cash flow for writing insurance.

At time t = 0, an underwriting division receives its premium. It places its allocated capital, A(0), in a safe investment.

At time t = 1, it returns the investment income on A(0) to its investors. The allocated capital needed to support the outstanding losses after time t = 1, A(1), is invested. The difference, A(0) – A(1), is returned to ABC's investors.

The process continues for times t = 2, 3, and so on, until all outstanding losses are paid.

If we view reinsurance as a substitute for capital, the transaction costs of reinsurance must be subtracted from the profit provision in the premium.

For the underwriting division to make its target rate of return, the profit provision in the premium must be at least as large as the difference between its initial allocated capital, A(0), and the present value of the cash flow above evaluated at a rate of interest equal to its target rate of return. This difference can easily be translated into a target combined ratio for the underwriting division.

THE FOURTH STEP in this analysis is to consider the effect of reinsurance. Buying reinsurance reduces the capital needed for the entire insurance company. It will therefore affect the capital allocation, with the greatest impact occurring in the lines of insurance covered by reinsurance agreements. This affects the cash flow discussed above.

If we view reinsurance as a substitute for capital, the transaction costs of reinsurance must be subtracted from the profit provision in the premium. Will the underwriting division's net profit provision be more or less than the difference between the allocated capital and the present value of the capital cash flow with reinsurance? It depends on the cost of the reinsurance and the cost of capital, as reflected in the target rate of return. This analysis provides a systematic way to compare the two costs.

Clearly, this exercise requires the financial skills to analyze the "ability of the insurer's capital and surplus to adequately support future operations through a currently unknown future environment." The right actuary can provide key input into this aspect of the insurance business by:

- Determining the amount of capital needed under a variety of strategies
- Allocating capital to underwriting
- Calculating the cost of capital needed to support to outstanding losses
- Allocating reinsurance transaction costs

Moving beyond this example, the right actuary could further reduce the necessary capital by hedging the insurer's losses or using other asset management strategies or both. This requires additional knowledge of capital markets and the various tools used to manage financial risk.

In discussing the actuary's role in DFA, Susan Szkoda said that "the DFA concept broadens the scope of the actuary's analysis to encompass the entire balance sheet as well as the company's business plans over some future horizon. The actuary must, therefore, deepen his or her knowledge to include assets, liabilities other than loss and loss adjustment expense reserves, off-balance sheet risks, and capital structures and requirements. The profession must deepen its understanding of the impacts of various exogenous factors (economic cycles, changes in capital markets, development of new types of risk transfer products) on our business. In a very real sense, DFA requires the actuary to evolve into a financial risk manager." ●

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