

ENTERPRISE RISK MANAGEMENT

CALCULATING ECONOMIC CAPITAL

Insurers are increasingly adopting mark-to-market accounting over a one-year time horizon to calculate economic capital (EC). When combined with a stress-testing approach to risk quantification, it's a methodology that yields quick insights into risk exposure.

By Ian B. Farr, Joe Lebens, Hubert Mueller and Mark J. Scanlon

Insurance companies around the world are stepping up their use of EC models. Nearly two-thirds (65%) of the respondents in Towers Perrin's 2006 ERM Survey reported that they were calculating EC on a regular basis, up from 53% in 2004. The survey also found that the calculation of EC is more prevalent in Europe (75% of respondents) and Asia (72% of respondents) than in North America (55% of respondents).

The shift to EC models has been driven in large part by the growing tendency of regulators to take account of such models in their capital adequacy assessments. In the U.K., internal capital assessments are required, and in Europe companies have the option of using internal models under the Solvency II proposals. At the same time, most notably in North America, increasing ERM scrutiny by the rating agencies and peer pressure from the subsidiaries of European multinationals have led to a growing group of EC adopters during the last year.

Since there is no universally accepted method for calculating EC, there have been significant growing pains associated with this movement. The difficult issues involve accounting, time horizons, risk metrics, and data. Finding a way through these technical issues and obtaining an initial (albeit approximate) set of EC results efficiently are key to achieving the business benefits that EC can bring.

ONE-YEAR HORIZON VS. PORTFOLIO RUNOFF

Perhaps the most notable distinction among the alternative EC methodologies is the question of time horizon — that is, the

horizon over which a range of risk outcomes is considered. The principal options here are a one-year time horizon or a portfolio runoff approach.

Use of a one-year time horizon requires a decision on the valuation basis for the closing balance sheet. Here the strong trend is for a mark-to-market approach reflecting the increasing adoption of fair-value accounting and the potential to trade the assets or liabilities in adverse circumstances to reduce risk exposure. The EC calculation is then based on the potential impact, over a one-year period, of adverse outcomes on the mark-to-market balance sheet, measured at the target confidence level — typically chosen to be consistent with the company's target credit rating.

It is important to note that even under the one-year approach, a runoff projection is still required, since the insurer needs to calculate the terminal value of liabilities at the end of the one-year horizon. The future uncertainty surrounding the risk beyond the one-year horizon (including the cost of capital required to support that uncertainty) should be captured within the mark-to-market value of the liabilities at the end of the year.

The one-year mark-to-market approach originated with the banking industry but has also been adopted by many European multinational composite insurers (life and P/C) and is now being adopted as the basis for insurer solvency regulation across Europe. A number of the largest North American insurers are also adopting such an approach in their EC calculations.

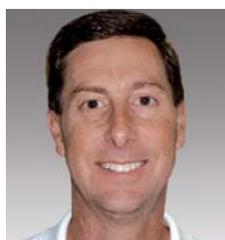
However, in North America, EC is still more commonly calculated using a portfolio runoff approach, particularly for P/C companies. This would also appear to be the direction in which principles-based regulation for the U.S. life sector is heading. Under the portfolio runoff approach, EC is determined as the level of assets, in addition to those backing the liabilities, required to pay future policyholder benefits and associated expenses at a given security factor consistent with the company's target credit rating.

While there are many pros and cons of each approach, the key factors explaining why a one-year mark-to-market approach has gained traction are:

- It connects risk quantification and risk management — the ability to control risk in the short term by trading assets or liabilities, including through reinsurance.
- It links risk quantification and risk management to performance management over the typical annual performance reporting cycle (thus consistently relating risk and reward).
- It is relatively easy to communicate (e.g., to nontechnical board members).
- It facilitates consistent aggregation across business units and risks (demonstrating diversification benefits).
- It can readily be calibrated (e.g., to bond defaults).
- It is relatively quick to calculate (particularly for life businesses).
- It involves less subjectivity (e.g., to assumptions about long-term management actions and asset volatilities).



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At the same time, some obstacles have to be acknowledged, particularly in relation to the applicability to P/C insurance risks, but also to mortality and longevity risks within a life business. These include:

- the difficulty in developing meaningful distributions of mark-to-market liability values (in one year) where current and historical market prices are not readily available for calibration purposes
- the relevance of such market price distributions to risk quantification and risk management when in reality the liabilities can be highly illiquid (particularly in adverse scenarios)
- the inability to provide significant input into certain longer-term risk management decisions, since the one-year approach does not provide sufficient information about the emergence of risks over longer time horizons.

Among life insurers, where market and credit risk comprise a major component of the risk profile, the one-year mark-to-market approach has been widely accepted. Acceptance has tended to be slower among P/C insurers, where insurance risk tends to dominate. For insurers writing both life and P/C business, a common approach is required to enable the accurate calculation of aggregation and the associated diversification benefits (see sidebar on page 13). Most of the major multinational insurers have adopted a one-year mark-to-market approach for this purpose.

The views of the rating agencies are also important to many insurers, and here there appears to be no clear preference as to

time horizon. The rating agencies' own capital adequacy assessments vary from factor-based approaches applied to a static balance sheet to longer-term stochastic calculations. At the same time, the rating agencies are currently encouraging insurers to implement a strong ERM framework, with EC as a key component within it. Here, their emphasis is on the completeness of the ERM framework, including the embedding of EC in the management of the business (see "Risk Management in Strategic Decision Making" on page 6 of this issue), rather than the particular method adopted for the calculations.

ONE-YEAR APPROACH: STOCHASTIC VS. STRESS TESTING

Selecting a one-year mark-to-market approach still leaves a number of choices as to its implementation. Conceptually, use of a stochastic approach in relation to the one-year risk exposure period has many advantages — particularly in terms of its ability to capture diversification benefits. For P/C business, stochastic modeling does not typically pose significant computational challenges and is therefore the methodology typically adopted. However, for life business, and business containing options and guarantees in particular, this has historically been seen as difficult computationally because it involves stochastic-on-stochastic calculations.

While the application of advanced modeling techniques derived from other industries (e.g., Tillinghast Smart Modelling™) has removed many of these computational issues, the one-year mark-to-market approach is often implemented, initially at least, using stress testing. This eases and speeds the

computation. It also provides a simpler mechanism to communicate the quantum and nature of an organization's risk exposures to nontechnical audiences (including company boards). The understanding gained from this process then greatly facilitates the embedding of risk management and EC within the organization.

Under a stress-testing approach, EC is measured as the difference in mark-to-market net assets between normal conditions and stressed conditions (see *Exhibit 1* on page 12). A set of stress tests is developed, covering the major risks to which the organization is exposed, and each calibrated to a probability level over a one-year time horizon consistent with the company's target credit rating. Separate stresses are selected to cover economic risks (e.g., credit, market), insurance risks (e.g., mortality, P/C reserve, P/C premium) and operational risks.

Results of the individual stress tests are then typically aggregated across risks and business units using a correlation matrix, with the correlation factors being based on observed or estimated correlations in the tails of the distributions. This approach to aggregation is necessarily approximate but nevertheless gives a good basic understanding as to how the risks interact.

IMPLEMENTING A STRESS- TESTING APPROACH

Most life insurers are capable of adapting existing models (e.g., embedded value, GAAP or cash-flow testing) relatively easily to implement EC using the stress-testing



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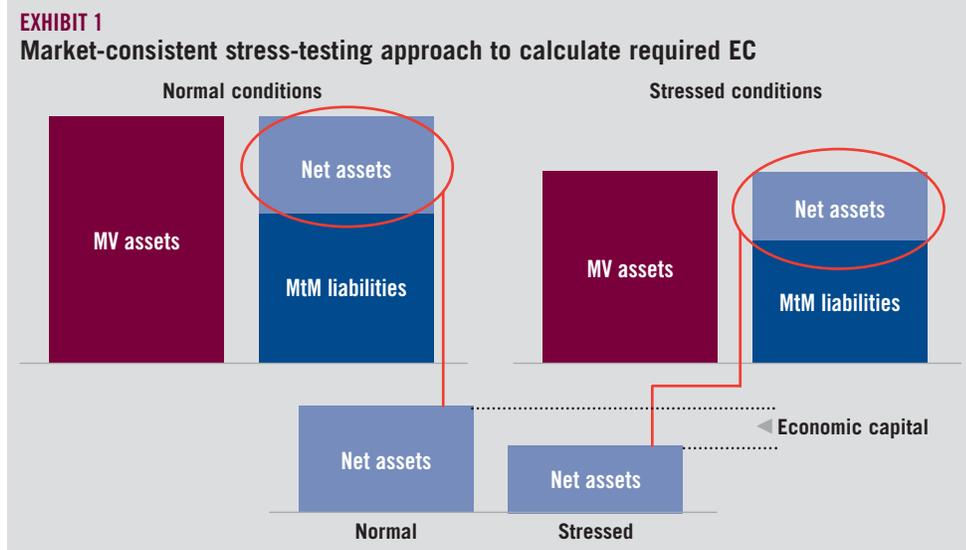


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approach. Nonetheless, stress testing can still pose a number of practical implementation challenges, in particular, relating to the derivation and calibration of the stress tests and correlations.

The use of a set of stress tests represents an approximation to a multidimensional stochastic approach. In calculating economic capital, we are seeking to establish a level of capital required at a certain confidence level across all risks. We do this by calibrating individual risk stresses to that confidence level and aggregating the corresponding individual risk capital amounts (as described earlier). During this process, a number of assumptions are implicitly made that need to be validated as reasonable in each individual situation. Alternatively, the methodology can be appropriately refined (e.g., to allow for nonlinearity of risk aggregation).

Obtaining an efficient set of stresses in this multidimensional environment involves use of techniques such as principal components analysis with interest-rate exposure being a key example. Here, yield curve movements are decomposed into a relatively small number of independent components (normally, three suffice) that together explain a high proportion of historical interest-rate movements. The first three components broadly correspond to parallel shifts, changes in slope and twists of the yield curve.



CALIBRATING TO HISTORICAL DATA

In practice, one of the big challenges in calibrating the stress tests is deciding on exactly which data to use and the quantity. For example, even when considering data from which to calibrate interest-rate stresses, there is a choice between government bond and swap rate data to be made.

A key consideration in using historical data to calibrate stress tests is deciding on how much history to use. One argument, particularly for market risk, is that only relatively recent data should be used (e.g., the last 25 years' market data) because this information is the most relevant given the structural changes in the market. The counterargument is that, by decreasing the data to calibrate the stress tests, the stresses will be limited to the extreme behavior

witnessed over that period, which is not necessarily the best indicator of possible future extreme movements. Hence, there is the risk that the stress is not extreme enough or, equivalently, that the actual level of confidence is lower than the stated level the company is targeting. This risk of understatement increases as the targeted level of confidence increases.

For insurance risks such as mortality and reserve risks, available data are generally much more limited compared to economic risks. In practice, the calibration of these stress tests requires considerable judgment. Results need to be interpreted with this in mind and sensitivity tests performed where the judgment is critical to results.

Aggregating results across business segments

Companies with both life and P/C insurance businesses will typically look to produce an enterprise EC figure that combines both business segments and demonstrates the potentially significant diversification benefit given the different nature of the underlying insurance risks (see *Exhibit 2*).

Providing a strong justification for this diversification benefit is essential in communication with regulators and rating agencies if they are to reflect that diversification in their capital adequacy assessments. Understanding the nature of the diversification benefit can also help a company make decisions on how to grow the two businesses.

CHALLENGES IN AGGREGATION

With many life insurance companies within groups adopting a one-year mark-to-market approach for calculating EC, and many P/C companies using some form of runoff approach, a dilemma arises with regard to their aggregation. Both operations will likely have invested a lot of time and expense in developing EC models and educating people in the respective businesses on how to use them. While each business would support determination of the enterprise-wide EC amount, most would prefer not to alter their chosen approach.

However, there is a fundamental difficulty in combining results that have been derived over different time horizons — even if the results use a consistent calibration to the organization's target credit rating. This difficulty arises because combining capital calculated over different time periods effectively allows risks in one time period to be hedged against other risks in a different time period — which is unlikely to be justifiable.

As well as differences in time horizon, there may also be other difference in EC methodology between lines of business — such as stochastic versus stress-testing approaches and differences in risk metrics (e.g., tail value at risk versus value at risk). All of these differences present challenges when it comes to aggregation. Ultimately, if EC results are to be aggregated between lines of business, and diversification benefits justified both internally and to external audiences, a consistent approach to EC calculations needs to be adopted across the organization.

BUILDING INTERNAL CONSENSUS

Developing agreement on an overall approach to EC is likely to be a time-consuming process, but one from which significant insights can be gained as a result of the differing nature of risks in the various businesses. The issues relevant to the final choice of methodology would include:

- the relative size and riskiness of the various businesses involved
- the availability of data within each line of business to support the alternative methodologies
- the capability of existing software and other tools to support the alternative methodologies.

In any event, it should be recognized that a customized aggregation tool may have to be built to bring together the line-of-business results. The level of complexity of such a tool depends on the range of businesses involved and the precise EC methodology agreed upon — with longer-term approaches typically requiring more sophisticated aggregation processes.

FASTER UNDERSTANDING OF RISK

A one-year mark-to-market stress-testing approach provides a relatively simple and quick way to quantify and communicate an organization's risk exposures — both internally and externally. Using such an approach, many organizations have overcome the numerous barriers to EC implementation and been able to produce EC results quickly and efficiently, without compromising the integrity of the results. This speed of implementation enables them to move rapidly to apply their enhanced risk understanding within their businesses, with competitive advantages.

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EXHIBIT 2

Measuring the enterprise diversification benefit

Enterprise diversification benefit

