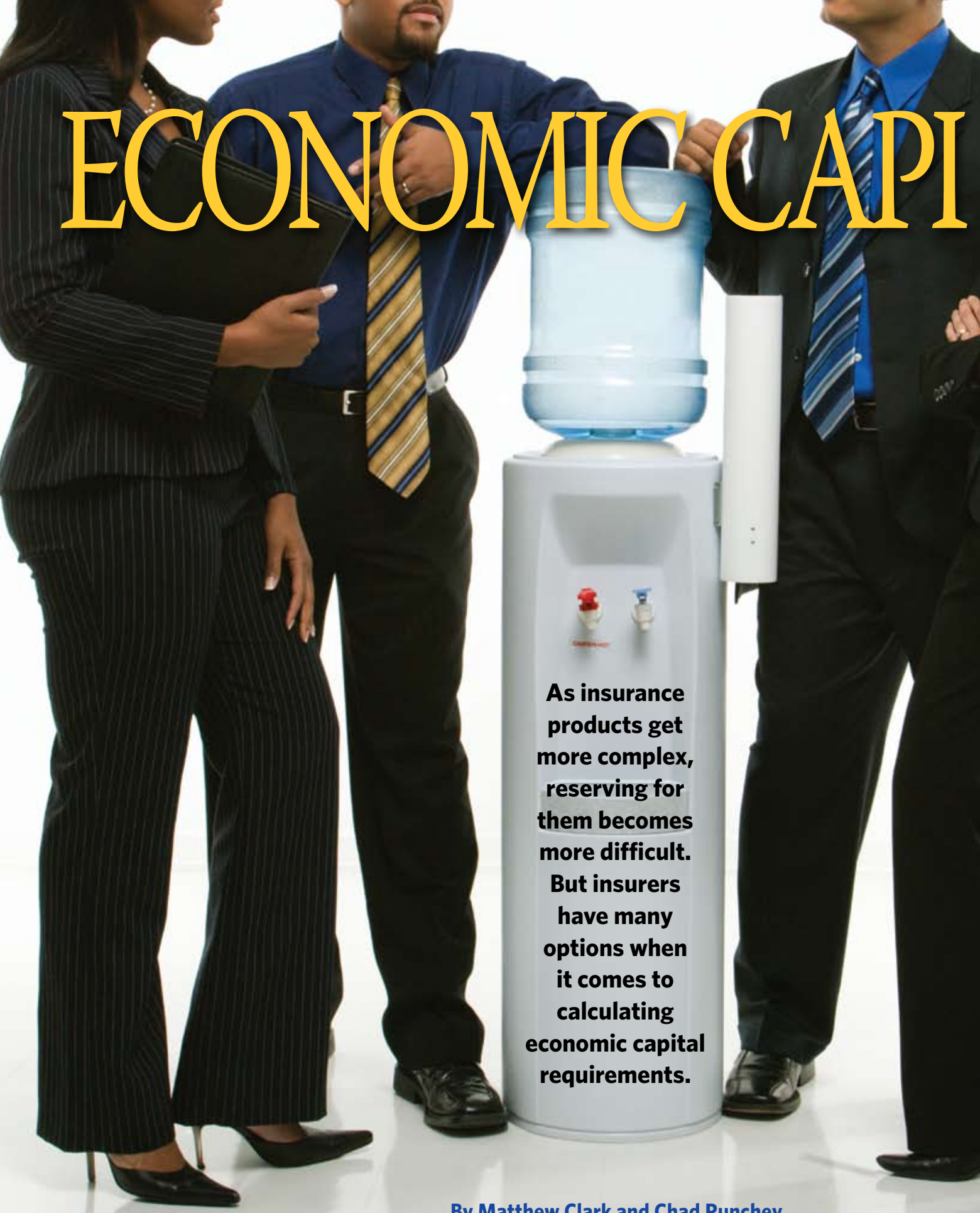
ECONOMIC CAPI



As insurance products get more complex, reserving for them becomes more difficult. But insurers have many options when it comes to calculating economic capital requirements.

By Matthew Clark and Chad Runchey

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The Controversy at the Water Cooler

ECONOMIC CAPITAL IS GENERATING INTENSE DEBATE at insurance company water coolers all around the world. Everyone seems to agree on the definition: Economic capital is the amount of capital needed to meet future obligations arising from existing business with a high degree of certainty over a defined time horizon. Likewise, there is agreement that today's insurance market requires capitalization guidelines that are linked to the risk composition of each organization. However, opinions differ sharply when it comes to deciding just which method of measuring capital requirements is the "right" one.

The plethora of choices is enough to make one's head spin. Several jurisdictions around the world have introduced economic capital frameworks, including:

- United Kingdom: Individual Capital Assessment
- Switzerland: Swiss Solvency Test
- European Union: Solvency II
- Australia/New Zealand: Standard 4360
- United States: C3 Phase II

The consensus seems to be that while most of these methods are easy to talk about, they present many challenges in implementation. Some practitioners say the end justifies the means. In other words, the method used to calculate economic capital depends on the desired use of that capital and/or the customer being served.

With all of the discussion, one would expect some similarities in how the industry approaches economic capital. But it appears that while most people have strong opinions on the subject, everyone's view is different when it comes to determining how required capital should be calculated, the degree of certainty we should seek, and the time frame over which to make the assessment.

Beyond these issues, there are a number of related debates about methodologies and assumptions, especially how diversification or aggregation effects should be recognized, correlation assumptions, and the treatment of regulatory capital in excess of economic capital estimates.

The Path to Economic Capital

How did we get ourselves into this quandary? Traditional factor-based insurance risk capital calculations date back to the 1970s. The current U.S. risk-based capital (RBC) calculation is an example of this approach. The factor-based approach served the industry well while the products offered by the insurance market were both simple—in that they lacked complex guarantees and options—and homogeneous, in that the risks inherent in the products didn't differ materially from company to company.

The past 10 years, however, have been an active time for insurance product development. New products and product features have evolved at unprecedented rates. Two primary examples are the living and death benefits now attached to both annuities and universal life products. Traditional capital models and valuation methodologies aren't equipped to handle the new features found in today's insurance products, which are no longer homogeneous or simple.

As a result, the traditional factor-based capital, reserve, and valuation systems have started to be questioned or replaced. On the valuation front, we've witnessed the emergence of principles-based reserves in Canada and their exploration in the United States, stochastic and market-consistent embedded value in Europe, and the fair-value concepts in international financial reporting standards (IFRS). Meanwhile, the regulators and rating agencies have struggled to keep up with the emergence of capital requirements. The approaches used by rating agencies such as S&P, Moody's, and Fitch are all marked by increased sophistication and a movement toward the economic capital concept.

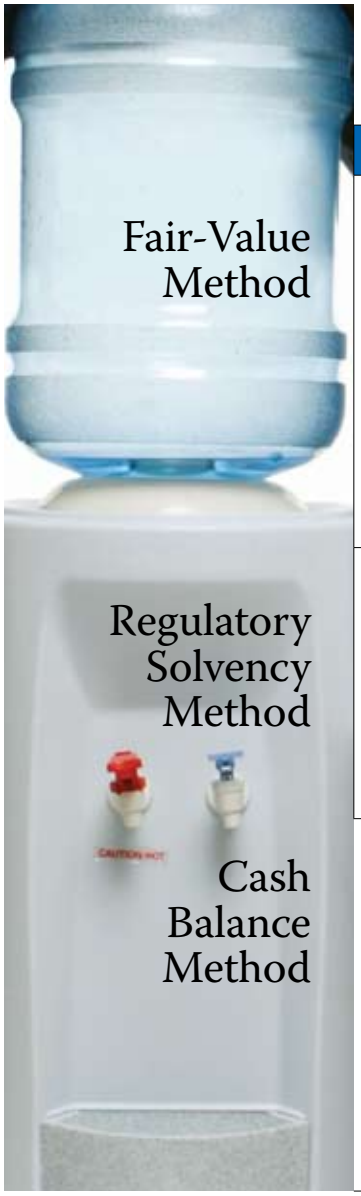

Exhibit 1
Pros and Cons of Methods of Calculating Economic Capital

	Pros	Cons
Fair-Value Method	› Consistent with emerging practice in Europe. › Consistent with banking methods. › Can be consistently applied across businesses, geographies, and jurisdictions. › Naturally aligns with emerging ALM and credit risk measurement practices and tools.	› No consistent basis for calibrating the liability and certain asset class fair values, making the resulting absolute level of capital highly dependent on the discount rate. › Computationally difficult when the liability contains path-dependent options. › One-year time horizon is counterintuitive to traditional insurance industry thinking about assets and liabilities. › Ignores statutory insolvency considerations when not consistent with statutory basis. › No link to GAAP or statutory accounting frameworks but could become consistent with IFRS.
Regulatory Solvency Method	› Consistent with emerging principles-based methods in the United States. › Linked to statutory capital frameworks used by regulators. › Does not require the use of nested stochastic processes. › Time horizon consistent with the long-term nature of the liabilities and the way insurance professionals view them.	› Highly correlated with a regulatory/accounting regime and difficult to apply consistently across different regulatory regimes. › Difficult to apply across different businesses: life vs. P/C vs. banking. › Inconsistent with emerging ALM and credit risk measurement practices.
Cash Balance Method	› Consistent with the desire to quantify capital needed to assure the payment of policyholder obligations. › Can be consistently applied across businesses, geographies, and jurisdictions. › Similar to regulatory solvency method, except that there are no balance sheets and income statements do not have to be projected. › Does not require the use of nested stochastic processes. › Time horizon consistent with the long-term nature of the liabilities and the way insurance professionals view them.	› Not linked to GAAP or statutory requirements. › No link to emerging practice in the United States or Europe. › Ignores accounting balance sheet, which could result in a calculation that fails to recognize a regulatory insolvency. › Inconsistent with emerging ALM and credit risk measurement practices.

Are We That Far Apart?

The emerging capital methods can be classified into three categories: fair-value methods, regulatory solvency methods, and cash balance methods. Each of these approaches can do a good job of measuring relative risk across products and risks, but each produces different absolute levels of capital. Each method also has its advantages and disadvantages (see Exhibit 1).

Fair-value method. In Europe, Canada, and Australia, a fair-value approach is taking hold and is extending into the United States as foreign-owned companies implement the methodology their parent companies use. The capital requirement is based on the volatility of the value of assets and liabilities over one year, with all options and guarantees measured at fair value.

In general, the fair value of assets is easy to quantify. As always, quantifying the fair value of the liabilities is the challenge. This method quantifies the capital needed to cover extreme net fair-value changes over a one-year period, which includes a liability sufficient to support its transfer to a third party at the end of the one-year time horizon. While the time horizon is one year, the remaining life of the assets and liabilities must, of course, be considered in determining the market value of the assets and liabilities. The liability calculation is typically performed using a risk-neutral calculation, discounted at risk-free rates.

Capital is typically defined by examining the distribution of the present value of economic surplus (defined as the fair value of assets, less the fair value of liabilities) one year hence, resulting from simulations across the various risk elements (independently or fully integrated). The resulting present values of economic surplus, when rank-ordered, define a distribution, and a point in the tail of the distribution is used to define the capital amount. Thus, economic capital in this context is the amount needed today to ensure economic solvency (including the ability to transfer the business) to a stated probability level one year hence (see exhibit1).

Regulatory solvency method. In the United States, regulators are taking a statutory solvency approach, as exemplified by the recent development of C3 Phase II, a methodology designed to capture the option risk on variable annuities. The regulatory sol-

Exhibit 2
Capital Amount Calculated by Different Methods

	Regulatory Solvency Method	Cash Balance Method	Fair-Value Method
Percentile	Capital Amount Needed		
99.5	$24,104	$18,675	$9,707
99.0	23,901	18,425	5,295
98.0	23,285	18,167	2,773
97.0	22,930	17,268	1,879
96.0	22,690	17,003	1,421
95.0	22,489	16,309	1,142
90.0	21,548	15,007	577
75.0	19,958	13,450	232
50.0	18,414	12,266	116

Example prepared without consideration of taxes.

vency method calculates the capital necessary to remain solvent on a regulatory basis over a defined time horizon.

Solvency is defined from a regulatory perspective. In other words, like the fair-value method, this method looks at the balance sheet. However, unlike the values used in the fair-value approach, here the values for assets and liabilities are defined by the regulatory framework. In the United States, for example, these typically would be book values. In addition, whereas fair value uses a one-year horizon, the regulatory solvency method typically looks at the life of the liabilities. It quantifies the capital a company needs to fund the remaining liability cash flows while remaining solvent from a regulatory perspective.

The regulatory solvency approach requires that assets and liabilities be projected over their remaining lifetimes. Income statements and balance sheets are projected for future periods, and regulatory capital is determined at each future point in time. A large number of simulations of this type are produced across all risk types. For each simulation, the projected future statutory surplus at each future point is discounted to the current date.

As with the fair-value method, the resulting present values of regulatory surplus, when rank-ordered, define a distribution of capital, and a point in the tail of the distribution is used to define the capital amount. The capital amount represents the funds needed today to ensure solvency in each future period with a certain confidence level. In this context, the discount methodology is linked to the underlying investment performance of the assets.

Cash balance method. A third emerging approach, the cash balance method, has had limited use to date. It calculates the capital necessary to fund future liability cash flows, without considering regulatory measures of capital. It's not necessary to project accounting results or the market valuation of the assets and liabilities. A forecast balance sheet isn't needed because only the liability cash flows are necessary. The exception would be when the liability cash flows depend on the statutory balance sheet, as in the case of participating dividends. Like the fair-value method, this method is attractive to companies that need to calculate capital requirements across jurisdictions.

As with the regulatory solvency method, this method requires that assets and liabilities be projected over their remaining lifetimes. Cash flows from the assets are used to fund liability outflows, with positive net cash flow reinvested and cash deficiencies funded through assets sales (or other disinvestment/funding approaches).

When asset cash flows have been exhausted, the remaining liability (unfunded cash flows) defines the capital requirement. As with the other methods, a simulation across all risk types is used to develop a distribution of results. The resulting present values, when rank-ordered, define a distribution, and a point in the tail of the distribution is used to define the capital amount. The capital amount represents the amount of funds needed today to fund the liability outflows over the projection horizon with a certain confidence level.

Putting Economic Capital in Perspective

When we compare the three methods described above, we can draw several broad conclusions:

- All three methods produce comparable relative amounts of capital. If one business has twice the risk of another business, all three methods generally draw that same conclusion (assuming common assumptions).
- Each of the methods will produce different results in an absolute context. Note that the differing time horizons of the methods will require using lower probabilities of solvency for longer time horizons. The inherent nature of each method will drive more or less capital than the other.
- Ignoring regulatory mandates, the use of one method over another depends on a number of factors, including the end use of the capital results. One extremely important factor is the business and geographic mix. It's difficult, for example, to adopt a regulatory-based approach across businesses subject to different regulatory regimes.
- All three methods are highly dependent on assumptions and inherent computational approaches that ultimately could distort results or prevent meaningful comparisons.
- The ultimate uses of capital should also drive the selection of a particular method.

Note that when comparing the results of the different methods, the tail metric used should reflect the time horizon. Given the one-year time horizon of the fair-value method, a comparison to an alternative method would require using a higher probability of solvency for the fair-value method because of the shorter time horizon (one year). Longer time horizons may result in targeting a lower probability of solvency.

To illustrate one method, we constructed a simple case study that examines the three alternatives. We used a block of in-force immediate annuities supported by non-callable corporate bonds and determined the capital needed to support the inherent interest-rate risk. In this example, the assets backing the liabilities were shorter than the liability cash flows.

Keeping the assets and liabilities fairly simple allowed us to avoid complicating the comparison and helped with some of the computational processes. Exhibit 2 presents the capital amounts defined by each method for the simulations in the tail of each distribution. Results are shown per million dollars of liability using modified conditional tail expectation (CTE).

Note that when comparing the capital requirements across methods, different percentiles would likely be used to be more in line with the time horizon of the underlying calculation. For example, the one-year horizon of the fair-value method may require looking at extreme points of the distribution, potentially out to a 99.95 percent confidence level. Longer horizons may lead to looking at a less extreme point—95 percent, for example.

Our preliminary research indicates that at the extreme tails, the three methods are likely to converge and show less of a difference. In addition, as the time horizon of the fair-value method is increased, the capital requirements under this method should converge to that under the other two methods.

There are many issues to consider when estimating economic capital requirements. Most arise regardless of which method of calculating capital is used.

As shown in the exhibit, on an absolute basis, the regulatory solvency approach produces the greatest amount of capital. This should not be surprising, since the regulatory balance-sheet framework causes insolvency before the cash balance method actually runs out of assets to fund the annuity payments. Both the regulatory solvency method and the cash balance method have the same liability cash flows. The difference is simply the timing of the recognized surplus deficiency, resulting from the change in statutory asset and liability values, and its relationship to the discount rate.

The difference between these two methods will become even greater when higher regulatory reserve requirements cause an insolvency, even though there may never be a time when assets aren't sufficient to fund claims. Universal life reserve requirements under Regulation AXXX and Actuarial Guideline 38 are clear examples of this outcome. This may seem counterintuitive to those who would argue that in circumstances where cash deficiencies don't exist, there should be no capital requirements. The counter argument is that the method is capitalizing at the level the regulator would use to come and "close the doors." Having enough cash to fund claims isn't the requirement. It's having sufficient levels of regulatory capital, a type of "going concern" requirement.

The fair-value approach produces materially lower capital. This shouldn't be too surprising either. With this method, the one-year dispersion of interest-rate scenarios isn't nearly as severe as that produced over the 30-year projection horizon used in the other two methods. While the valuation of liabilities at the end of the one-year horizon does require the projection of the cash flows over 30 years, the valuation is based on mean values, not tail results, for each one-year scenario.

Other Differences and Challenges

The numerous decisions insurance companies must make when determining capital requirements present the opportunity for different answers. Some of the common issues faced in implementing a risk capital methodology include:

New business: The addition of new business will affect the amount of capital required. In some cases, it will reduce the amount of capital; in others, it will increase it. Depending on the purpose of the analysis, new business might or might not be desirable to include. For example, regulatory or rating agency compliance might reasonably exclude new business. But capital planning and budgeting should consider new business requirements.

Tail definition: The discussion about tail definition can have a significant impact on the capital levels generated. There are two popular approaches used by the industry: value at risk (VAR) and tail VAR (TVAR or CTE). The VAR approach identifies the capital level using a defined value in the tail of the distribution. This is achieved by ranking the results and identifying the scenario that corresponds to the desired confidence level.

The tail VAR is similar to the VAR, with one important exception. The tail VAR takes the average of the tail scenarios defined by the desired confidence level (e.g., the tail VAR using a 95 percent confidence level would take the average of the value between 95 percent and 100 percent).

How one handles positive results in the tail VAR approach can also affect overall capital levels. Not allowing positives produces higher capital and may change the relationship of capital amounts across risks and products. This method of excluding the positive results is referred to as modified CTE. Naturally, the approach taken has implications for the level of capital.

Confidence level: The desired level of assurance regarding solvency will determine the confidence level selected. The confidence level selection will drive different absolute and relative levels of capital. The notion that the selected value should be linked to a company's rating is a popular approach. This means that higher-rated companies require higher levels of capital.

Aggregation techniques and assumed risk correlations: How results are aggregated will affect overall capital requirements. Fully integrated risk models that reflect the nonlinear nature of correlations can alleviate this problem, but this frequently is impractical. Common aggregation approaches are scenario combination, the use of copulas, and correlation matrices. The scenario combi-

nation approach uses the risk distributions, typically using rank order or similar techniques. Copula and correlation approaches employ statistical techniques that require the parameterization of the relationship between risks.

In all methods, a key decision is the degree of correlation among risks, especially the correlation of risks when risk factors are in distress. The relationship between risk elements over the distribution of events is typically not static, and such an assumption between risk elements is suspect. This area clearly requires greater research and understanding, yet it's a major driver of the level of capital indicated by any calculation method.

Scenario generation: This always presents a problem, since how one calibrates scenarios will drive different capital results. Integrating elements such as credit and inflation further complicates the problem.

Double counting: The double counting of the impact a risk has on the capital requirement is a recurring implementation issue, especially when independent measurement of capital for different risks is employed.

Period-to-period reconciliation: Once results are produced for two different periods, analyzing why everything changed presents a monumental challenge. We favor developing methods to roll capital forward from period to period and to reconcile changes over time.

Selecting the "Right" Method

As the above examples show, there are many issues to consider when estimating economic capital requirements. Most, if not all, of these issues arise regardless of which method of calculating capital is used.

Each of the methods of calculating capital has its advantages and disadvantages, its supporters and critics. The selection of a method should be driven by several factors, including:

- The question you're trying to answer and how to use the results.
- The perspective (e.g., shareholder, regulator, rating agency, policyholder, management) from which you want to calculate the capital needed.
- Whether you're trying to calculate capital over multiple jurisdictions.
- Whether your goal is to quantify capital requirements or to manage risk.

This is where your head might start to spin. Why are there so many different methods? Which is the right one? Like a child in a candy shop, insurers are faced with many choices, each of which has merit, and there's a danger that they'll have buyer's remorse when they get home. The challenge facing insurers is to evaluate their options and adopt an approach that's consistent with their needs. ●

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