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Capital Assessment for Insurers

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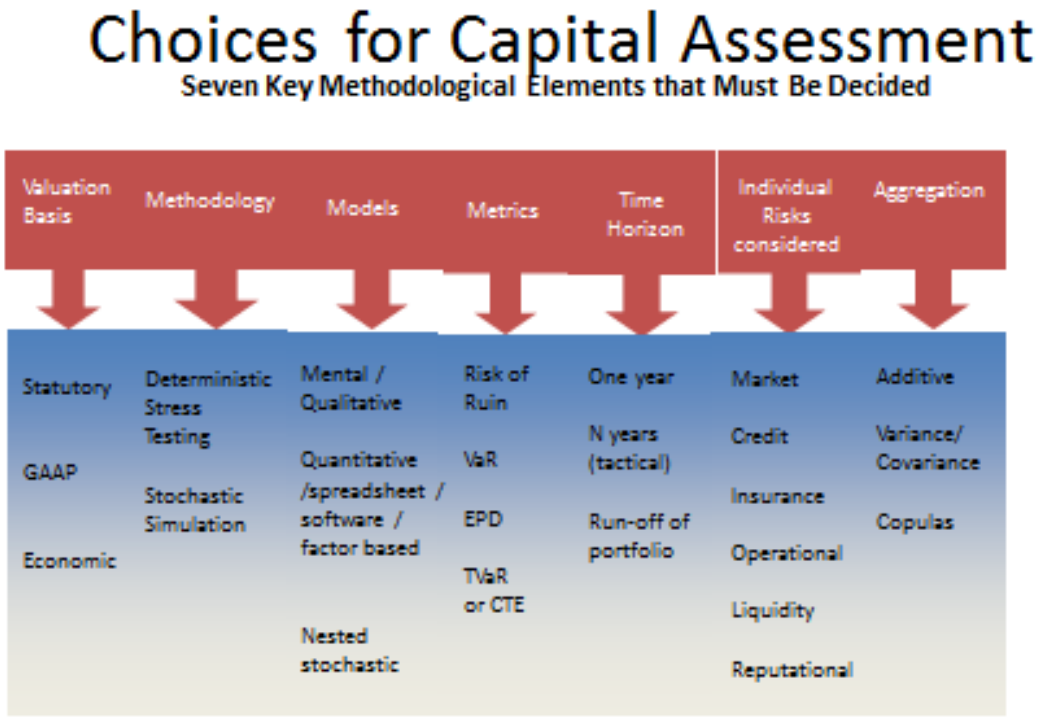
Methods of calculating risk capital are not standardized. Each company is unique and should consider their specific needs. This aligns well with the ORSA regulation, where the focus is on the "O" in Own Risk Solvency Assessment.

This article will approach the topic from a high level, providing a general idea of the myriad of choices available. Capital that is risk-based contributes a consistent metric for the firm's CEO, the chief allocator of capital, to differentiate between alternative uses of a firm's hard earned surplus. A reasonable methodology encourages insurers to embed the process in their daily activities as ORSA requires. Results are aggregated across risk and line of business, considering interactions and diversification between risks. One insurer may have an aggressive risk culture while another is conservative. This is reflected in the risk appetite, but will also appear in the assumptions chosen when calculating capital. The peer reviewer, or regulator, should recognize these differences between companies when looking at the results.

Capital assessment must balance all of these choices, knowing that they interact with each other sometimes in unintended ways. Assumptions set in models can impact decisions made about risk appetite or risk limits. In a proverbial chicken and egg discussion, should risk appetite and tolerance be set before aggregating risk capital developed by models or should the models showing current status determine these risk thresholds?

In general, developing risk capital requires you to think about the following categories.

- Valuation basis
- Methodology
- Models
- Metrics
- Time horizon
- Individual risks considered
- Aggregation method



The analyst can think of the many options as a lock with seven spinning mechanisms. Each company will choose a different combination, and more than one could make sense for a company.

When asked to peer review a capital assessment, a large part of the process can be described using these categories. The original assessment should be described clearly, and perhaps explain why one choice inside a category was made rather than others. Each choice forces someone to think through the various options.

Valuation Basis

There are many ways to define surplus, but all are based on netting the difference between values of assets and liabilities. Insurers have various accounting regimes to choose from when managing their company. Each is a little bit different. Some define cash flows as net income, which can be very confusing. Some include target surplus based on a regulatory requirement, rating agency factor, or internal economic capital estimate. Most will use net results after tax, but there are variations. Statutory accounting in the insurance industry focuses on the balance sheet and tends to use conservative

assumptions. GAAP accounting is designed for a going concern company and looks primarily at the income statement. For risk management, including capital assessment, many companies use economic values based on pure cash flows. Economic values also include off-balance sheet items and realistic assumptions for pension plans. It is reasonable for a regulator in the U.S. to ask how a company considers statutory accounting in their assessment.

Economic capital models may provide additional data points for the regulator if using pure cash flows that are not dependent on any accounting regime. For example, life and health companies currently perform asset adequacy testing that is based on statutory accounting profit metrics, so metrics based on cash flows add new information to analyze.

Once the basis is chosen, income and cash flow are created from models. These can be simple or complex, and various inputs to the environments are created using everything from a few deterministic scenarios to stochastic techniques with millions of scenarios. This is combined with the current risk profile (balance sheet items), tactical business plans, and strategic plans.

Methodology

Capital assessment can take many forms, with the size of company and lines of business generally driving the choices made. Here are some examples that will not surprise an examiner. A small insurer is less likely to run stochastic simulations. A life insurer will include interactions between assets and liabilities, while a casualty insurer will generally run them independently. The goal is to identify potential adverse capital events and their impact on a specific risk profile, noting the impact on risk capital targets and thresholds. Multiple metrics are often used, focusing on either a point estimate (single number) or incorporating a range of outcomes.

The primary separation of methodology is between deterministic (discrete) and stochastic testing. With deterministic scenarios, each one is chosen for a specific reason. They can be reverse stress tests, where poor end results are imagined and scenarios that create these results are tested, or sensitivity tests where assumptions are tested, often in ways that are assumed to consider both positive and negative connotations. These are easier to present to board members as you can craft a narrative around the scenario.

It is important to view the impact that various stress events might have on capital levels and share those results with the Board. Even if the insurer focuses on stochastic analytical techniques, this is an important task to complete. Stress tests provide estimates of how much capital remains relative to those levels targeted by the company for ratings and solvency. They might show the impact of a major earthquake in a key part of California, the impact of a 100 bp movement in interest rates, or a shift in medical loss ratios. These

scenarios should be considered by companies to ensure they hold enough capital to withstand reasonably likely events and continue as an ongoing entity.

When quantification tools include stochastic simulation, they can be driven by assumptions such as claims, or general economic conditions like interest rates or inflation. These general assumptions must be consistent across all models (e.g., assets, liabilities). Monte Carlo techniques are often used, where a random number generator creates a series of scenarios based on parameters including the initial level, average expected level over time, and expected volatility. These scenarios can then be graphed or parameterized to a known statistical distribution to illustrate the likelihood of poor events and display extreme events. Extreme scenarios result in what is often referred to as "the tail".

While companies almost always include some form of quantification in their capital assessment models, qualitative analysis can often be useful as well. This provides initial, common sense analysis (what do you think drives results) that leads to further scrutiny. As results move up the reporting hierarchy, quantification tends to be replaced by narratives that describe what could go wrong and how bad it could be. Discussing the difference between normal results, plausible events and catastrophic events can help leaders determine their risk appetite and the resulting risk limits. These levels of adversity allow a frank discussion of the business and its risks. What could go wrong? What could go right?

Models

Capital assessment can be accomplished using a wide variety of sophistication, from mental models that qualitatively make arguments for capital needs to nested stochastic models that attempt to identify higher order interactive results. Peer reviewers should question models that provide extremely precise results yet are built on assumptions that allow minimal rigor. A good quantitative model has qualitative descriptions to accompany it, explaining why certain assumptions and specific levels of refinement were chosen.

Qualitative models focus on exposure and high levels of probability and/or severity for a given risk. This can be useful for a risk with minimal variability, where running lots of scenarios will provide an obvious result, as well as one that is binary. Binary risks follow Boolean logic; they either happen or they don't. Some risks can be modeled in different ways for different uses. An earthquake may be modeled as a binary risk by a small casualty company located in a known earthquake zone where the event would create a solvency risk, while a company writing homeowners insurance nationally might utilize a stochastic analysis of its expected claims that are diversified geographically.

It is also important to recognize various protections within the balance sheet, such as reinsurance, that mitigate gross exposures. Large losses and attritional losses are often

modeled separately to allow for the measurement and benefit of per risk and catastrophe reinsurance treaties. These contracts are then layered on top of direct exposures to generate the net exposure, with reinsurer counterparty risk acknowledged.

Historically, the National Association of Insurance Commissioners (NAIC) has utilized risk factors to allocate capital, using more sophisticated models to estimate the capital necessary for each type and tier of risk. An insurer's exposure is then multiplied by the factor to generate the required capital for an individual risk.

Quantitative methods vary from simple spreadsheets to the use of modeling software, sometimes incorporating separate and distinct asset and liability projections. Run times become material when these projections interact (e.g., products that credit interest and generate an account value).

Models that run without being encumbered by balance sheet calculations like universal life reserves can run much faster. This allows more stochastic scenarios to be run, for example, or a greater focus on detail. Sometimes reserve approximations, such as holding cash surrender values rather than statutory reserves for universal life products, are used to accomplish these objectives.

Metrics

Measurement is a key part of a capital assessment. It can be a statistical measure utilizing stochastically simulated results, or it can utilize standard formulas developed by a rating agency or regulator. The specific metric is less important than whether the results are used to manage the insurer. An unsophisticated metric that is being used is better than a sophisticated metric used only for the capital assessment. That being said, several metrics are commonly used.

Value at Risk, or VaR, is a metric that utilizes stochastic results and bases conservatism on the percentage of results worse than that chosen. For example, a 95 VaR would choose a threshold where 5% of the stochastic results were worse than that. The metric was developed by banks, and the Basel requirements use VaR. It can be very useful during periods of calm, but comes up short when a crisis arrives and correlations between risks increase.

The data used in a VaR analysis can come from historical results, a parameterized standard distribution such as the normal distribution (common), or using Monte Carlo simulation techniques. Unfortunately the tails of the distribution tend to be fatter than expected (kurtosis) when using the normal distribution, a frustrating result when capital is being calculated based on adverse deviations, leading to a false sense of security. The results can't be added, meaning that rather than running a stochastic model for each risk and summing them, a complex stochastic on stochastic model must be run.

Because VaR creates a single point estimate, it becomes relatively easy for an astute modeler to manage to the model, making it look like there is little risk when in reality the tail is much worse than represented. An example of this was seen during the financial crisis, where some insurers hedged their variable annuity exposure to a 30% decline but not beyond. Once the decline went past that the companies were fully exposed. A strong capital assessment will share enough information to avoid this situation, either including a graph of all the scenario results or utilizing multiple metrics.

One issue with VaR is that assumptions are frequently updated. This makes it procyclical, creating problems because it increases required capital during times of stress and defeats the purpose of capital. A factor based capital requirement, although not as sophisticated as other models, has the advantage of releasing capital as exposure reduces, making it easier to continue as a going concern.

A metric called Tail VaR, or CTE (continuous tail expectation), gets past most of these shortcomings but is not widely supported or used except by the insurance industry. Here the metric looks at the average of all scenarios beyond the point chosen. This makes it much harder to manipulate the result, and the results are additive. Given that the data is available when VaR is being calculated it is unclear why both metrics are not generated on a regular basis.

Several other measures come from statistical teachings, some with variations. The risk of ruin looks at how likely it is that you will lose all your capital (e.g., in a single coin flip it is 50%). You can reduce this by diversifying across risks, finding better opportunities, or hedging. Many investors find out the hard way that leverage (debt, margin accounts, unhedged derivative positions) increases this risk.

The simplest metrics are based on exposures. They provide a form of worst case scenario. For example, a gross exposure to mortality is $100,000,000 if that amount of life insurance was written (reduced by reserves accumulated prior to death and reinsurance). The exposure to junk bonds is the book value of any bonds rated below investment grade. Static metrics like duration can also be used to manage risk and lower capital requirements.

The NAIC has limited concentration of specific asset exposures for many years. This concept can be extended to liabilities, liquidity, and personnel matters (e.g., to generate a diversity of thought by limiting the number of graduates from one university).

Time Horizon

How far from the current time into the future are losses measured? Does a projected loss need to occur within one year, within the tactical business plan, 30 years, or during the run-off of the portfolio? It depends upon what the goal is. If the goal is to illuminate the risk during normal trading operations, then a short time horizon is appropriate. For an

insurer who has made promises to clients that are measured in decades, a single point of failure along the way results in insolvency. Some products (e.g., P&C, major medical health, annually renewable term) tend to be shorter-term (primarily one-year) in nature, reasonably allowing for application of shorter timeframes.

Individual risks considered

The general risk categories defined by the NAIC for its risk-based capital metric generally do a pretty good job of covering the risks of an insurance company, and can support risk management at a non-insurance company too. The insurance/underwriting risk category is what most non-insurers consider operational risk. They hedge their exposure through the purchase of an insurance contract, reducing their risk and adding to the insurer's risk. Risks can be stratified in great detail or not based on how the specific risk is managed.

At a very high level, risks are categorized by assets, liabilities, and operations. These each drill down by differentiators like asset class and product type in an effort to have the splits be consistent with how the risks are managed. Risks will vary by type of insurer, and are reported net of formal mitigation efforts like reinsurance.

Some examples of risks considered are:

- Market risk - changes in interest rates, equity prices, volatilities, credit spreads, real estate values and foreign exchange rates
- Credit risk - failure of debtors, bond issuers, reinsurance partners or counterparties to meet payment obligations or by changes in their creditworthiness
- Insurance risk
    - Non-cat and catastrophe risk - unexpected occurrences of catastrophe and non-catastrophe events beyond the risk levels included in the price of the insurance contracts.
    - Reserve risk - inadequacy of reserves, for example caused by unanticipated loss trends or inflation
- Operational risk - inadequate internal processes, or from personnel and systems, or from external events
- Liquidity risk - failure of meeting short-term current or future payment obligations
- Reputational risks - significant direct losses or losses in future business caused by a decline in the company's reputation

While many risks have standardized modeling techniques, some deserve additional description from the insurer in how they perform their capital assessment and others are rapidly evolving. Investment strategy, in particular, has several outlier companies that

invest heavily in real estate, equities, and even entire companies. These can challenge rules of thumb and provide difficult interaction considerations that are fair game for a peer reviewer to ask about.

Aggregation methods

The question here is whether, and how, to give credit for diversification between risks as they interact. This can be an important difference between otherwise similar capital assessments. If one assumes no diversification, then capital backing individual risks can be calculated separately and are additive. This would normally overestimate the aggregated capital as risks are rarely fully correlated. For example, the risk of both a 1 in 100 hurricane hitting the US and a 1 in 100 credit crisis in the same year is much lower than either by itself. A few large companies will model this risk using brute force with lots of computers to aggregate capital across risks, but the time this requires is massive. Consequently, it is standard practice to incorporate a correlation matrix to combine capital for individual risks into a total. If the correlations are 1.00, the result is the same as simply adding them together. But an experienced practitioner can build a reasonable matrix, or one can be calculated. An additional complexity uses copulas to aggregate economic capital, where the correlations vary across a set of stochastic scenarios. For example, most of the time risks may be considered to have correlations of .7, but if extreme scenarios are detected the correlation increases to .9. This is more common among asset classes during a tail event, but could also reflect a regional carrier writing both auto and homeowners in a region prone to flooding. Performing sensitivity testing of a correlation matrix can be a helpful analysis to the modeler even if the results do not appear in the final report.

Traditional risk based capital developed by the NAIC assumes risks are independent, with zero correlation between major risk categories. This is conservative in almost all cases, but provides a consistent measure of capital requirements between insurers.

Capital Allocation

A key component to measurement of capital is how to allocate it back to specific products and business units. An insurer that has integrated risk into their day-to-day operations will be able to discuss how they align this with their capital allocation method. Many insurers will use factors that can be input to models. Some will apply diversification benefits and others will manage aggregation at the corporate level. These decisions impact investment income allocation, return on equity calculations, and pricing decisions.

Conclusion

Performing a capital assessment covers a wide range of practices. Some that seem simple may be more useful for a specific company than those that seem sophisticated. Each insurer should consider its own risk profile, strategies, and culture before deciding. For a capital model to be useful, it must be integrated into a company's decision-making

process. It should be a core element of strategic analyses, growth initiatives, and risk mitigation approaches (e.g., reinsurance) to ensure capital is used efficiently. This requires modelers to accept a level of simplification, as an overly complex model can be difficult to implement and can be difficult to describe to board members. It is critical that ultimate decision-makers do not become reliant on a model that they can't understand or explain.

Feedback to risk owners is just as important as the initial rolling up of capital required for each individual risk. Some risks are important to mitigate, or seek out due to diversification benefits, and product lines are unlikely to know that on their own. An example of this is when a P&C company with exposure to hurricane risk might diversify into areas where hurricanes are not prevalent but another risk, like earthquake exposure, is. Assuming the expertise is present, this may be a method to reduce overall correlation expectations by adding a risk that is currently underrepresented. This type of acquisition strategy, where limited overlap is sought out, is common.

Capital assessments differ from statutory requirements in that they are designed for going concern insurers, while regulators often look at insurers as closed block entities. A regulator might be more interested in a relatively more conservative calculation, through changes in assumptions or specific metric used (e.g., 90 CTE vs. 70 CTE). When calculating an ORSA it is important to integrate the assessment with the way the insurer is managed. This will lead to better understanding of how assumptions integrate with a risk profile, but also improve the assessment over time by including the risk owners in feedback loops.

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