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Measuring Returns after Reflecting the Rental Cost of Rating Agency Capital

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Background

Donald Mango presented a paper on "Insurance Capital as a Shared Asset" at the CAS 2004 Annual Meeting and published a revised version in the 2005 ASTIN Bulletin [1]. Rodney Kreps presented a paper on "Riskiness Leverage Models" at the CAS Spring 2005 Meeting [2]. To clarify and integrate these approaches to profitability measurement, the author has written discussions of both of these papers [3], [4]. This article will first summarize material from these papers and then present a proposed integration of these approaches.

Insurance Capital as a Shared Asset

Donald Mango treats insurance capital as a shared asset, with the insurance contracts having simultaneous rights to access potentially all of that shared capital. The aggregation risk is a common characteristic of shared asset usage, since shared assets typically have more members who could potentially use the asset than the asset can safely bear.

A consumptive use involves the transfer of a portion or share of the asset from the communal asset to an individual. Non-consumptive use involves temporary, non-depletive, limited transfer of control. While the intended use of a hotel room is benign occupancy (non-consumptive), there is a risk that a guest may fall asleep with a lit cigarette and burn down a wing of the hotel (clearly consumptive).

Mr. Mango notes that the generation of required capital, whether by premiums or reserves, temporarily reduces the amount of capacity available for other underwriting. Being temporary, it is similar to capacity occupancy, a non-consumptive use of the shared asset. Capacity consumption occurs when reserves must be increased beyond planned levels: funds are transferred from the capital account to the reserve account, and eventually out of the firm.

Mr. Mango summarizes by stating that the two distinct impacts of underwriting an insurance portfolio are as follows: (1) Certain occupation of underwriting capacity for a period of time, and (2) Possible consumption of capital. He notes that this "bipolar" capital usage is structurally similar to a bank issuing a letter of credit (LOC).

Every insurance contract receives a parental guarantee: Should it be unable to pay for its own claims, the contract can draw upon the company's available funds. The cost of this guarantee has two pieces: (1) a capacity occupation cost, similar to the LOC access fee according to Mr. Mango, and (2) a capital call cost, similar to the payback costs of accessing an LOC, but adjusted for the facts that the call is not for a loan but for a permanent transfer and that the call destroys future underwriting capacity.

Mr. Mango defines his key decision metric, economic value added, to be the NPV return net of expected capital usage cost:

EVA = NPV return – capacity occupation cost – capital call cost

The capacity occupation cost is computed as the product of an opportunity cost rate (minimum risk adjusted hurdle rate) and the amount of required rating agency capital generated over the active life of the contract.

Capital call costs are risk loads calculated using the following algorithm:
(1) For each iteration (loss scenario) in the simulation, calculate the deviation of the loss for

each segment from the expected loss. If the deviation from the mean is positive, there is no capital call and no capital call cost. If the deviation from the mean is negative, the capital call cost equals the product of the magnitude of the deviation and the capital call cost factor.

(2) Calculate each segment's share of the portfolio capital call cost as the ratio of the segment cost to the total of all segment costs.

(3) Use the procedure in (1) to calculate the portfolio capital call cost. Multiply the portfolio capital call cost by the segment shares from (2) to calculate each segment's share of the capital call cost for that scenario.

(4) Each segment's expected capital call cost is average of (3) over all scenarios.

This conditional risk allocation method has become known as the RMK algorithm. Mr. Mango points out that this method extends risk valuation from the aggregate portfolio level down to segments that comprise the portfolio. Each segment's contribution to the portfolio risk is reflected, yielding an internally consistent allocation of diversification benefits for which risk charges (costs of capital) are additive in any combination.

We have an asymmetric dynamic, where additional capacity from upside scenarios rarely compensates for the lost capacity of downside scenarios. This is particularly true after occurrence of extreme events, when pricing can become excessive for a limited period of time. Capital call costs are intended to compensate for these missed opportunities [4].

For examples tested in the discussions ([3], [4]), when a reinsurance program is in place for a line of business and is invoked by a loss scenario, the average capital call cost factor for the line of business is applied to the deviation of the simulated reinsurance loss from the mean reinsured loss. This generates a credit capital call cost in the reinsurance line, which reduces the average capital call cost for the line of business when combined with the reinsurance line.

Tail Penalty

Notes from the 2005 CAS Seminar on Reinsurance session on "Risk Load, Profitability Measures, and Enterprise Risk Management" illustrate the flexibility which this approach permits management in quantifying risk preferences. In Mr. Mango's notes entitled "Insurance Capital as a Shared Asset—Theory and Practice," he points out that rating agency required capital can provide a convenient means to introduce a tail penalty.

An additional charge can be assessed for exceeding allocated rating agency capital (this would be analogous to burning down a wing of a hotel in our illustrative example). In computing the capital call cost, Mr. Mango assesses a moderate charge for damage within a segment's allocation (drawdown on allocated capital), and a much more severe charge for damage beyond a segment's allocation (drawdown of other segments' capital).

Assuming that correlations between segments are estimated with reasonable accuracy, this reviewer believes that this two-step approach has the advantage of discouraging company threatening accumulations of risk, which is the central goal for an enterprise risk management system. For those willing to allocate capital as an intermediate step in allocating the cost of capital, the tail value at risk and semi-variance metrics would also serve this function [4].

Riskiness Leverage Models

Rodney Kreps has written an important paper on the central topics of risk load and capital allocation for profitability measurement [2]. Riskiness leverage models are a class of mathematical models that satisfy two highly desirable properties of a risk load or surplus allocation method (additivity and allocable down to any desired level of definition). Tail value at risk and excess tail value at risk reasonably satisfy the properties that management would likely want of such a model, while still satisfying the properties of a riskiness leverage model and the properties of coherent measures of risk [3].

Integration of RORAC and EVA

The traditional return on risk-adjusted capital (RORAC) approach presented by Mr. Kreps [2] does not reflect rating agency capital

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"Capital call costs are intended to compensate for these missed opportunities."

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requirements, particularly the requirement to hold capital to support reserves until all claims are settled. This is very important for long tailed casualty lines.

RORAC is computed as the ratio of expected total underwriting return to allocated risk capital, and represents the expected return for both benign and potentially consumptive usage of capital. This author developed a modified RORAC approach, called a risk return on capital (RROC) model. A mean rating agency capital is computed by averaging rating agency required capital from the simulation. The mean rental cost of rating agency capital is calculated by multiplying the mean rating agency capital by the selected rental fee (an opportunity cost of capacity).

Expected underwriting return is computed by adding the mean NPV of interest on reserves and interest on mean rating agency capital to expected underwriting return (profit & overhead). The expected underwriting return after rental cost of capital is computed by subtracting the mean rental cost of rating agency capital. RROC is computed as the ratio of the expected underwriting return after the rental cost of capital to allocated risk capital.

Risk capital is a selected multiple of Excess Tail Value at Risk (XTVAR). Capital is allocated to line of business based upon co-excess tail values at risk (co-XTVAR) [3]. RROC represents the expected return for exposing capital to risk of loss, as the cost of benign rental of capital has already been reflected. It is analogous to the capital call cost in the EVA approach, here expressed as a return on capital rather than applied as a cost.

Mr. Venter has noted that co-XTVAR may not allocate capital to a line of business that didn't contribute significantly to adverse outcomes [5]. In such a situation, the traditional RORAC calculation may show the line to be highly profitable, whereas both EVA and RROC may show that the line is unprofitable because it did not cover the mean rental cost of rating agency capital. The author believes this to be a key advantage of the RROC approach.

Comparison of Three Approaches

In the EVA approach, risk preferences are reflected in the function selected and parameterized in computing the capital call cost. In the RORAC and RROC approaches, risk preferences are specified in the selection of the statistic used to measure risk and allocate capital. All three approaches utilize the RMK algorithm for allocating risk (measured as a capital call cost in EVA and as risk capital in RORAC and RROC) to line of business.

In practice, the RORAC and RROC approaches would be parameterized to allocate the total capital of the company. Total capital would be maintained to at least cover rating agency capital required for its desired rating [4].

Simulation Comparison

The discussion papers use simulation to illustrate differences between approaches [3], [4]. The examples in the discussion of Mr. Mango's paper measure the impact on profitability, rating agency capital, and risk capital due to rate changes, changes in the distributions of premium written by line, inaccurate pricing due to parameter and model risk, correlation between lines, alternative reinsurance programs, and alternative capital call cost functions.

One example tested the impact of a court decision declaring recent tort reforms to be unconstitutional. As it happened for a long tailed line, EVA deteriorated dramatically and RROC declined much more significantly than RORAC. This was caused by the mean rental cost of rating agency capital increasing materially due to increased reserves held for a long period of time.

In another variation on the base example, it was recognized that a profitable line was correlated with an unprofitable line. EVA deteriorated for

both lines and the portfolio. For the ROE measures (RROC and RORAC), profitability decreased dramatically for the profitable line because its losses now contribute more significantly to adverse scenarios created by the unprofitable line. Capital required to support the portfolio under the ROE approaches increased significantly.

The reinsurance examples demonstrate that reinsurance programs can reduce risk capital much more significantly than they reduce required rating agency capital. The portfolio returns with reinsurance improved because a smaller share of capital is allocated to a marginally profitable line and greater shares of capital are now allocated to highly profitable lines.

Alternative capital call cost function parameters were tested (*e.g.*, the consumption fee for capital less than required rating agency capital is xpercent of the consumption fee for common capital). Test results illustrate the critical importance of this EVA assumption.

Future Work

As rating agency required capital evolves to measure company specific risks such as catastrophe risk, then the selected rental fee used in computing RROC should be adjusted upward. It would no longer represent an opportunity cost of capacity, but should now reflect charges for the company specific risk elements reflected in rating agency capital. The risk model used to compute RROC should now be parameterized with these company specific risk elements excluded from the loss data. RROC would now measure returns attributable to risks assumed that are not measured by rating agency capital.

Conclusions

Mr. Mango's innovative work developing concepts of insurance capital as a shared asset and EVA contribute significantly to understanding the ways capital supports an insurance enterprise and must be financed. The EVA approach permits one to charge for risk (capital usage) and measure profitability at any desired level of definition while satisfying the key additivity property for risk charges without needing to allocate capital. EVA allows stakeholders flexibility in reflecting risk preferences.

Mr. Kreps has written an important paper on risk load and capital allocation. He has given us a class of mathematical models satisfying the desirable properties of a risk load or surplus allocation method (additivity and allocable down to any desired level of definition). TVAR and XTVAR also satisfy properties likely desired by management and are coherent measures of risk.

A risk return on capital (RROC) model is suggested as a way to integrate desirable properties of the EVA approach and the RORAC approach based upon riskiness leverage models. RROC measures returns after reflecting the mean rental cost of rating agency capital. Returns that are a reward for exposing capital to risk of loss are measured after reflecting the cost of carrying capital to support premium written and loss reserves.

Supplementary Material

Seminar notes from 2005 seminar on reinsurance on "Risk Load, Profitability Measures, and Enterprise Risk Management," which may be downloaded from the CAS Web site. ✦

References

[1] Mango, Donald, "Insurance Capital as a Shared Asset," ASTIN Bulletin, Vol. 35, No. 2, 2005, p. 471-486 (*ftp://ftp.math.ethz.ch/hg/users/astin2005/contributed_papers_astin/Mango.pdf*).

[2] Kreps, Rodney (2005), "Riskiness Leverage Models," CAS Spring 2005 Meeting, accepted for publication in 2005 CAS Proceedings.

[3] Bear, Robert A. (2005), Discussion of "Riskiness Leverage Models," accepted for publication in 2005 CAS Proceedings.

[4] Bear, Robert A. (2006), Discussion of "Insurance Capital as a Shared Asset," submitted to CAS Forum.

[5] Venter, Gary G., "Capital Allocation Survey with Commentary," The 2003 Bowles Symposium, *North American Actuarial Journal*, April 2004, p. 96.

> "RROC measures returns after reflecting the mean rental cost of rating agency capital."

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