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Framework Construct for a Basic Reinsurance Optimization Model

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The basic purpose of modeling should be to help develop an appropriate cession strategy that will maximize achievement of the reinsurance goals. This involves modeling a variety of mixes of reinsurance coverage at various limits and retentions and with various loss-sensitive features in order to achieve an optimal program.

The model can be developed to use the loss data to evaluate recoveries by mapping treaty/facultative cession arrangements on the claim distribution data. The model has to take into account the various layers of reinsurance cover as well as the premium paid for each layer.

The "what if" reinsurance arrangements modeled include quota share, surplus and excess of loss. For each alternative arrangement, the results of the model can be produced in terms of underwriting profit and loss gross and net of reinsurance with appropriate ratios.

For each class of business, the approach should be to analyze complete five years' data, in order to achieve the following:

- Develop an understanding of the pattern of risks underwritten in terms of a distribution of the claims and insured values (for those policies on which there had been a claim along with the associate premium).
- Develop an understanding of the pattern of losses in terms of a distribution of claims by size of individual loss.

Based on the above analysis, we sought to develop an appropriate cession strategy that will maximize the changes of achievement of reinsurance goals.

The key steps for the basic optimization of reinsurance arrangement is as follows:

- Selecting appropriate retention levels and validating the current retention
- Adjusting the existing layers and limits
- Estimating the net claim cost in each layer
- Testing the underwriting results with a coparticipation feature and an aggregate layering arrangement

In the case of catastrophe excess of loss programs, these should be analyzed at a minimum by developing loss scenarios based

Figure 1.
Parameters and Characteristics to Consider When Optimizing Reinsurance

on historical loss simulations. This is intended to give a baseline for developing possible future occurrences and should elaborate on the details of frequency and severity characteristics of subjects insured, as it requires detailed understanding of the underlying risk attached to the subject insured.

Figure 1 depicts the parameters and characteristics that should be analyzed and modeled for the purpose of reinsurance optimization.

The simulation exercise for an insurance company can be thought of as a pure loss simulation or a simulation for mapping reinsurance arrangement.

PURE LOSS SIMULATION: MAJOR SIMULATION APPROACHES

The pure loss simulation can be divided into two categories:

- Historical simulation, which involves random projection of historical losses
- Monte Carlo (based on assumed loss distribution) simulation, which involves random projection of historical losses based on assumed patterns of loss. Assumptions could be based on loss ratio, certain pattern and statistically known distributions.

Simulation for mapping reinsurance arrangement: Based on projected loss (either on historical or Monte Carlo), reinsurance arrangements are mapped to test the underwriting results. The simulation also involves the projection of volumes.

As a practical matter, having a very slow development pattern (long tailed) will often produce results showing either zero or very high projected ultimate layer losses by year. The actuary will often need to use smoothing techniques, such as the Bornhuetter-Ferguson approach or the Cape Cod (aka Stanard-Buhlmann) method, to produce a final experience rate.[1]

A very useful methodology for reinsurance optimization is described as follows:[2]

Phase 1 Set goals and constraints of the optimization.
Phase 2 Create gross of reinsurance model and validate results.
Phase 3 Create net of reinsurance model, validate results and verify limit and retentions are adequate.
Phase 4 Evaluate current contracts.
Phase 5 Set initial analysis as current structure and determine capital savings.
Phase 6 Determine efficacy of each contract and adjust as needed.
Phase 7 Determine efficacy of the revised structure and adjust as needed.

In phase 1, the goals and constraints of the optimization will be based around the risk appetite, or the risk that the company has the capacity to undertake. This can be, for instance, value at risk of no more than 20 percent capital erosion in one year; value at risk of surplus over regulatory capital must be maintained at 2.5 times at all times; maximize return on revenue and capital; minimize the required capital and so on. As multiple goals frequently will be used, a weighted ranking of these goals will have to be made.

Once phases 2, 3 and 4 have been completed, phases 5 and 6 require evaluating the net capital savings due to reinsurance. This can be done through simple equations like the following:

Net return = net underwriting profit – expected return on capital (%) * risk-adjusted capital on net basis

Expected return on capital is the return that shareholders in insurance and reinsurance companies expect. The risk-adjusted capital is usually derived from capital models like UAE's Insurance Authority's Eforms or A.M Best's BCAR model. If the net return is positive, then it means reinsurance is beneficial and is acting as a capital relief. Another way to evaluate reinsurance is to see that costs of reinsurance should be lower than costs of capital saved with reinsurance.

Effectiveness of each contract is measured by looking at cost of capital for that contract. Cost is the difference in the mean underwriting profit with and without the contract. Capital savings can also be seen as the difference in net required capital with and without the reinsurance contract.

Gross loss ratios should also be compared to net loss ratios by lines of business. This will usually present a trade-off to the insurance company, as when loss ratios are reasonable, net

loss ratios will tend to be higher than gross loss ratios. This is because most of the proportion of profitable business will be shifted to reinsurers. But when loss ratios are very high, net loss ratios will be lower than gross loss ratios, as reinsurers will bear a significant portion of those losses.

To elaborate on the impact of reinsurance treaties, particularly nonproportional arrangements, see the proportion of claims greater than some reasonably large claim amount like AED 1 million as proportion of total gross and net claims paid. The proportion of claims greater than AED 1 million on net claims should be far lower than that of gross claims in order to show that the insurance company is significantly protected from large losses by nonproportional reinsurance arrangements.

Another way to see the impact of reinsurance arrangements is to compare (a) expense ratio as proportion of gross premium for the line of business to (b) its reinsurance commission received as a proportion of gross premium. If (a) is greater than (b), it usually indicates suboptimal reinsurance. However, this consideration should be seen holistically with other metrics before arriving at any decision.

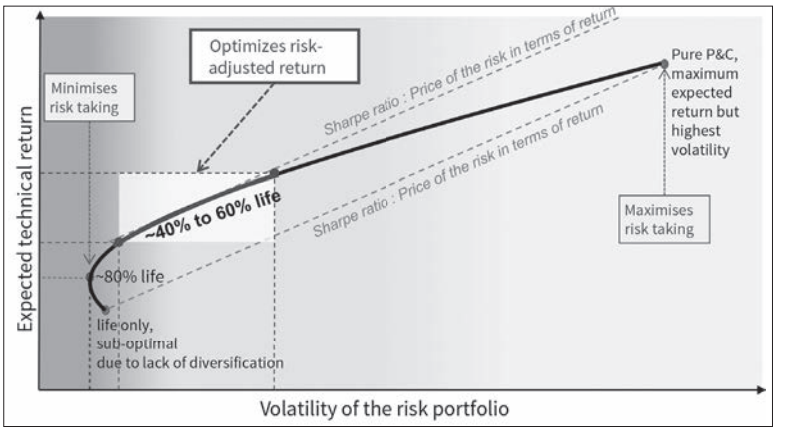
Phase 7 is then to compare the benefit of the new structure to the current structure based on cost and capital savings. If the new structure has lower costs and more capital relief than the current one, then the current structure should be replaced. If not, changes must be made to the new structure until reinsurance optimization has been achieved.

It is also vital to test a number of structural changes for the new structure, not just a few. For instance, different proportions for quota limits should be tested. Is the claim basis in the reinsurance arrangements based on loss occurring or claims made or risk attaching basis? Further, different attachment points should be evaluated for excess of loss. Top and drop, number and size of reinstatements, terms, benefits and conditions of the reinsurance contracts can be expanded or contracted to see their impact. Insurance issues around counterparties and other reinsurers should be assessed as well.

The advantage of this methodology is that it is broken down into many steps and hence is transparent for management to evaluate. It also allows us to see the effects from multiple angles and goals simultaneously. It is basic enough to be widely understood and be computable and is not complex enough to require too many sophisticated tools and models that bypass the capacity of management in emerging markets completely.[3] It is, however, time-consuming, and the number of different structures and variations chosen still require deep understanding of constraints, risk appetite and market pricing of treaty terms and conditions.

SCOR Re shows how it balances and optimizes diversification and expected returns with volatility when focusing on the

Figure 2.



Source: Denis Kessler, The Reinsurance Industry in 2020, SCOR Re, *https://www.scor.com/images/stories/pdf/Inverstors/financial-reporting/presentation/scor_thereinsuranceindustryin2020_v2.pdf.*

portfolio composition between life and general/property and casualty (P&C) insurance.[4]

SCOR optimizes returns in the 40–60 percent range between P&C and life. This makes sense, as having only life means lack of diversification and lower expected return but lower volatility as well. P&C reinsurance is far more volatile, erratic and heterogeneous than life and has higher returns.

The balanced composition ensures good returns and controllable volatility.[5]

For reinsurance pricing, we believe that Patrik's 13-point program is comprehensive but not so complicated that reinsurers in emerging markets would decide not to use it.[6] Briefly, these 13 points are:

1. Gather and reconcile primary exposure, expense and rate information segregated by major rating class groups.
2. Calculate an exposure expected loss cost and, if desirable, a loss cost rate.
3. Gather and reconcile primary claims data segregated by major rating class groups.
4. Filter the major catastrophe claims out of the claims data.
5. Trend the claims data to the rating period.
6. Develop the claims data to settlement values.
7. Estimate the catastrophe loss potential.
8. Adjust the historical exposures to the rating period.

9. Estimate an experience expected loss cost and, if desirable, a loss cost rate.

10. Estimate a "credibility" loss cost or loss cost rate from the exposure and experience loss costs or loss cost rates.

11. Estimate the probability distribution of the aggregate reinsurance loss, if desirable, and perhaps other distributions, such as for claims payment timing.

12. Specify commission, internal expense and profit loads.

13. Negotiate, reconcile opinions and estimates, alter terms and conditions.

Data interpretation is crucial when making a basic reinsurance optimization model. Are we using the right time period for our analysis? For long-tail casualty lines, it is important to observe and measure trends over short as well as a longer period of time. Short-term measurements could be "noise" and long-term measurements could be "signal." Also, do we fully understand actual reported activity? Is the actual reported activity overly influenced by large loss activity? Conversely, has there been a slowdown in claims reporting?[7]

Moreover, is there a systematic and observable trend over a period of accident years? This is a strong signal of changes in the market dynamics. Is the observed trend consistent over a period of time? If it is consistent it might mean that change in the reinsurance cycle is about to happen.[8]

A range of outputs should be produced to communicate the results of the reinsurance optimization model to the business. These include:[9]

- Trade-off between risk and return of various reinsurance options
- Break-even return periods between reinsurance premium and reinsurance recoveries
- Breakdown of claims and recoveries by return period and claim type
- Penetration by claims layer and by number of reinstatements
- Impact on company's risk appetite/risk profile
- Impact on economic profit/risk-adjusted profit
- Key performance indicators like retention ratios, loss ratios .125

Ceded reinsurance leverage is defined as "the ratio of ceded insurance balances to policyholders' surplus. Ceded reinsurance leverage represents the extent to which an insurance company relies on ceding risk to reinsurers. Ceded insurance balances include ceded premiums, net balances for unpaid losses and unearned premiums."[10]

Ceded reinsurance leverage is used as a barometer for how much an insurance relies on shifting policy risks to others. A high ratio indicates that the company relies heavily on others to help defray risk, a situation that carries with it its own risks. If reinsurance companies demand more money for assuming risks, the insurance company may find itself exposed to a larger risk than usual.

Another threat to the future health of an insurance company relates to how many reinsurers a company uses when transferring risk. A heavy concentration of ceded insurance in a small group of insurers can lead to a situation in which companies may be unable to collect from reinsurance companies, either because those companies are unwilling to fulfill their obligations or because they are unable to. If the insurance company only offers policies in a single state and in a single line, it could face serious risks.

Having a high ceded reinsurance leverage does not mean that an insurance company is headed to impairment. While there is a risk that the reinsurance companies used could find themselves unable to fulfill their obligations, using reinsurance companies that either have good credit ratings or can provide letters of credit may keep underwriting risks low. ■

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ENDNOTES

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2 Guy Carpenter, "Reinsurance Structures and 'Optimization,'" presented at CAMAR 2012 Fall Meeting, October 10, 2012, West Winsor, New Jersey.

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10 Investopedia, "Ceded Reinsurance Leverage," *www.investopedia.com/terms/c/ceded-reinsurance-leverage.asp, accessed November 27, 2016.*