

BADEN BADEN Class Report

DAY 3

VOLATILE RETENTIONS



MODELLING

Model Factors

Whereas models based on detailed policy level information consider loss for an individual risk, those models commonly referred to as aggregate catastrophe models use portfolio level information to arrive at expected losses. **Nicolas Georgy** considers what isn't being modelled by these aggregate models and assesses the potential to underestimate loss from natural hazard exposures.

The major natural hazard events of 2004 and 2005 have raised concerns about the most appropriate type, structure and amount of reinsurance protection to buy, and how to price these different protections. One clear reaction was to question the validity of catastrophe models and their reliability for pricing catastrophe covers. Although improvements have been made as a result

of the last two years of hurricane experience, a number of issues still need to be addressed.

Within an aggregate catastrophe model, analysis of the expected loss to a portfolio from natural hazards tends to focus on the geographical spread of the portfolio and the segmentation of the risks by building and occupancy type. In aggregate models, little attention is given to the distribution of

risk size within the portfolio, or to programme structure before catastrophe excess of loss (cat xl) protection. In reality, however, the risk size distribution and programme structure strongly impact the volatility of an insurer's net account, and as some markets move towards buying cat xl on a gross basis, the need to consider the implications of these factors becomes ever more important.



PROGRAMMES

Adopting a new programme structure

Insurance companies have different reinsurance options to cover their natural hazard exposures. In the more traditional reinsurance product, cat xl protection is combined with proportional quota share and surplus treaties, and protects only the client's retention (referred to as 'net'). The proportional protections are generally designed to ensure that the cat xl is only exposed to losses due to major events where hundreds or thousands of similarly sized risks are simultaneously damaged. In a pure non-proportional structure,

the cat xl covers a 'gross' retention that has no inuring proportional protection, but may have inuring per risk protection. In Asia, Eastern and Southern Europe and also occasionally in Latin America, insurers are establishing gross reinsurance structures to cover natural perils. The gross retention may have a very unbalanced risk profile, and if it does, excluding natural perils from the per risk protection leads to a volatility that aggregate based catastrophe models do not properly measure and reflect.

The reason that aggregate level catastrophe models can fail to properly address the issue is that natural hazards, such as earthquake, hurricane, and flood, cause a wide range of damage ratios (loss as a percentage of the total sum insured) to individual risks within a portfolio. Aggregated data does not convey useful information about the size of the risks, and the models operate on the assumption of a well balanced, uniform risk size distribution. As a result of this assumption, the potential for the large damage ratios to affect the

large risks is ignored. This is a problem, because the combination of large damage ratio and high insured value results in a high absolute loss that can be a significant proportion of the overall event loss, and which can thus significantly drive up the volatility of catastrophe losses. This increased volatility in event losses for a portfolio protected on the gross leads to higher volatility of the insurer's net retention compared to net structures, and therefore to an increased capital requirement or balance sheet threat.

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Net retention volatility study

IN BRIEF
Aggregated data does not convey useful information about the size of the risks.

Partner Re analysed a real case portfolio comprising about 4,000 different-sized risks concentrated in a critical earthquake exposed area (similar to for example, Istanbul, Tokyo, Beijing or Santiago).

Using its aggregate level CatFocus™ earthquake model, Partner Re simulated the impact on the portfolio from three selected earthquake events of different magnitude. The events were selected to represent loss return periods of 30, 65 and 150 years. For each event, the aggregate model generated an estimation of the mean damage ratio (MDR) to the portfolio, together with its standard deviation (a widespread measure of volatility).

The method was then applied in five steps:

- Select the relevant event (return periods 30, 65 or 150 years).
- Define 4,000 (number of risks) beta-distributed random variables to model the damage ratios

on the individual risks in the case of the selected event. This is a commonly utilised method that has been calibrated against historical events and shown to have a reasonable fit. The range of possible values is between 0 and 100%, making normalisation of the results unnecessary. The parameters of the beta variables

were calibrated against CatFocus™ output.

- Simulate 100,000 realisations of each individual loss event using Monte Carlo methodology (Figure 2 is an example of one such realisation). This samples most of the possible combinations of large loss ratios and large individual losses.

- Test the reinsurance structure performance by applying it to the detailed loss profiles produced during each of the 100,000 simulations.
- Observe and compare the distributions of each realisation for each event under the three different reinsurance structures.

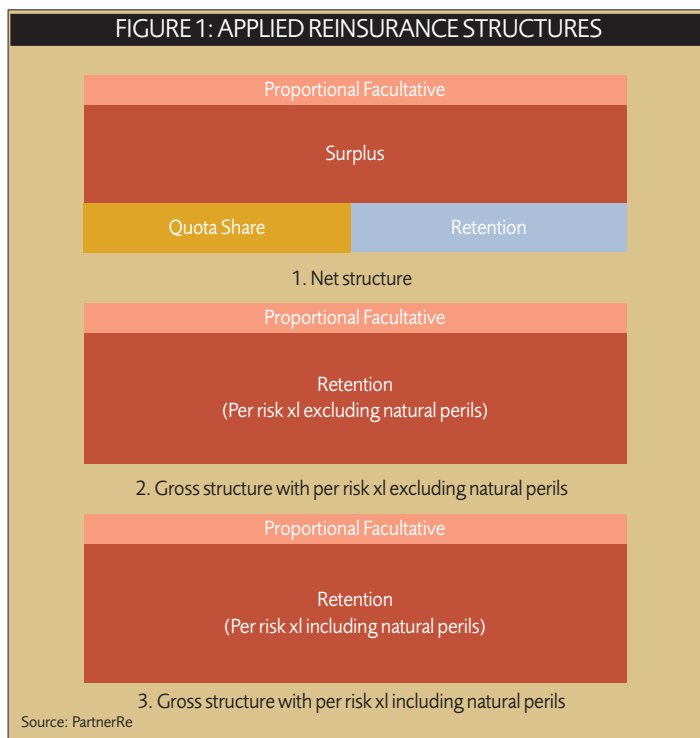
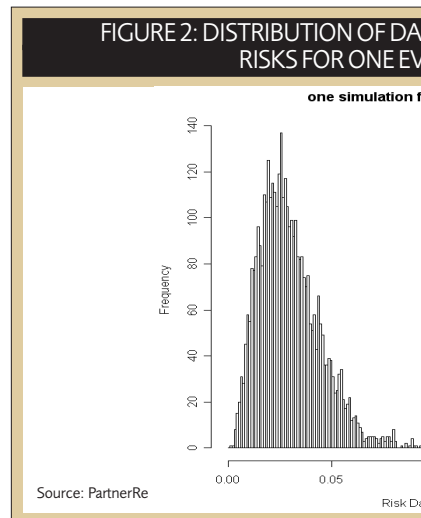


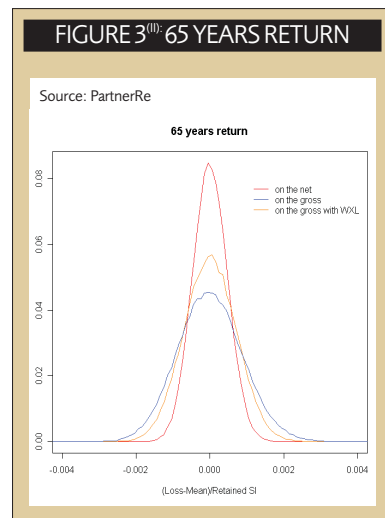
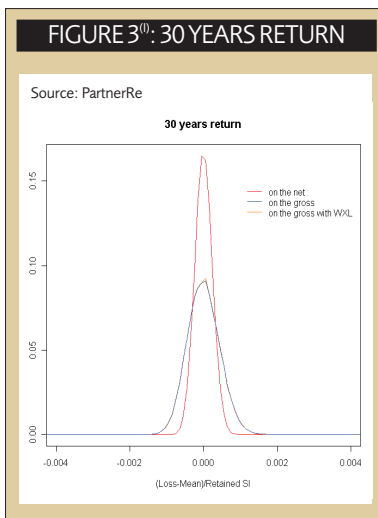
Figure 1: The study used three reinsurance structures, before cat xl protection, to show how programme structure influences the volatility of an insurer's net retention for natural hazard exposure.



IN BRIEF
Studying the differences in the simulated mean damage ratio and variation around the mean under the three given reinsurance structures for each analysed event.

The charts in Figure 3, right, show the simulated mean damage ratio to the portfolio and variation around the mean for the three analysed events (with return periods of 30, 65 and 150 years). For all events, the narrower damage spread

resulting from the net (shown in red) compared to the gross (shown in blue) structure reflects the result of the difference in size of the maximum net retentions. The gross protection with wxl including natural perils (shown in orange) shows volatility similar to that of the gross structure for lower magnitude events and more similarity to the net structure for higher magnitude events. This is because lower magnitude events frequently do not trigger the wxl.



APPLIED REINSURANCE STRUCTURES

Partner Re applied three different, but widely purchased, reinsurance structures:

- Net: Gross retention protected by a 50% quota share and surplus treaty. Proportional facultative above the gross retention.
- Gross: Gross retention protected by a per risk working excess of loss (wxl) that excludes natural perils. Proportional facultative above the gross retention.
- As (2) but with a per risk wxl that includes natural perils and which has unlimited reinstatement. Proportional facultative above the gross retention.

Partner Re defined the structures such that:

- 1% of the risks need (proportional) facultative coverage.
- The surplus treaty covers 7.5% of the risks.
- The priority of the wxl is the market standard.



ANALYSIS

Standard deviations

The standard deviation of the mean damage ratio for each structure was used as the specific measure of net retention volatility. In the study, the standard deviation for the gross coverage is a multiple of that of the net, a relation that is almost constant for all three events. The charts show that the standard deviation of the gross with wxl including natural perils varies between that of the net and that of the gross with a wxl excluding natural perils. The percentiles follow the same pattern and can be approximated by the mean damage ratio plus a multiple of the standard deviation.

IN BRIEF

The 65 year event shows that a net structure would face a 10% probability of suffering a 90 year mean damage ratio, whereas with a gross structure, there would be a 10% chance that the severity of the event loss would be that of an event with a 175 year return period.

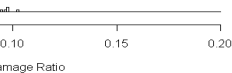
probability of suffering a 90 year mean damage ratio, whereas with a gross structure, there would be a 10% chance that the severity of the event loss would be that of an event with a 175 year return period. With a wxl with unlimited reinstatements that includes natural perils protection, the equivalent return period decreases to 140 years. If the number of reinstatements is limited, this effect is reduced to a value somewhere in the 140-175 year range. For more intense events (with a larger mean damage ratio), the difference between the structures would be even more evident.

This multiplier will increase for portfolios with a larger percentage of large risks (for example, heavy industrial portfolios).

From the generated loss curve, the 65 year event shows that a net structure would face a 10%

DAMAGE RATIOS FOR INDIVIDUAL EVENT SIMULATION

for the Beta function



ANALYSIS

Results and conclusion

IN BRIEF

The reinsurance buyer is getting far more certainty of protection at any chosen level under the net than gross structure.

The implication of this result is that the reinsurance buyer is getting far more certainty of protection at any chosen level under the net than gross structure. In the net case, there is a 10% chance that what on average should be a 65-year event turns out as bad as an average 90 year event. For the gross case the uncertainty is higher, and there is a 10% chance that the loss will be as high as an average 175 year event. Looking at this from the cedant's buying perspective, if the cedant purchases cover up to the average 65 year event, they would have a 10% chance of

only having 55 years of protection on the net structure. However, on the gross structure there is a 10% chance that the cedant is only protected from a 20 year event.

The logic behind this result is as follows. With a net structure, a cat xl can cover hundreds of individual risk retentions, whereas under a gross structure, the number is likely to be as much as a factor of ten lower. Cat xls with limits expressed as a percentage of retained aggregates are not therefore offering the same protection for the cedant on a net basis, as on a gross basis. In addition they do not have the same volatility, and thus they cannot be identically priced. The choice of reinsurance structure has a direct consequence for the size of the cat xl that the cedant should purchase to be sure of sufficient protection for their net account, and on the price that the cedant should pay for their cat xl protection.

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THE Review

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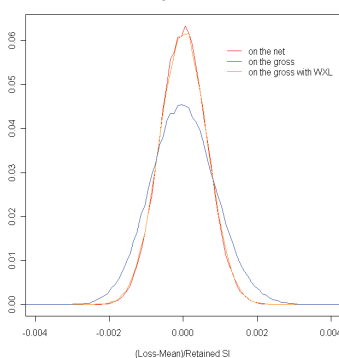
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FIGURE 3^(III): 150 YEARS RETURN

Source: PartnerRe

150 years return



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