

## Long Term Reinsurance Buying Strategies modelled using a component based DFA Tool

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### Abstract:

This paper compares several long-term reinsurance buying strategies for a catastrophe XL programme. The pricing of the programme layers vary over the years depending on the loss experience to the programme. The reinsurance strategies can be described as 'Constant Cover' and 'Constant Spend' strategies. The modelling is done using ReMetrica II - a visual component based DFA tool developed by Benfield Greig. The risk/return characteristics of the strategies are shown and assumptions and realism of the model discussed.

Keywords: Reinsurance, DFA

## Introduction

This study investigates possible reinsurance buying strategies over many years. In particular, we take a typical catastrophe XL programme and model the change in pricing over a 5 year period. The study then compares two reinsurance buying strategies:

- Constant Cover – The cedant buys a constant cover ( fixed limits and fixed coinsurance ) each year with a varying amount of premium spend.
- Constant Spend – The cedant varies the amount of cover ( fixed limits but varying reinsurance ) each year but maintains a constant amount of reinsurance premium.

We use Monte Carlo simulation to estimate and compare the risk and return characteristics for each strategy. We then discuss the assumptions of the model and conclude with implications for real world strategies.

## The Model

For our example model we are using a property Cat XL programme with the following figures (USD million):

- Premium Income            120
- Expenses                    30
- Small Claims      40% of 120
  
- Large Cat Loss Frequency    Poisson distribution with mean 1.
- Large Cat Loss Size            Lognormal distribution, mean 12, standard dev. 16.

The reinsurance programme consists of 4 layers as follows:

| Limit | Deductible | Midpt | Initial ROL |
|-------|------------|-------|-------------|
| 10    | 20         | 25    | 11.6        |
| 20    | 30         | 40    | 6.9         |
| 50    | 50         | 75    | 3.4         |
| 50    | 100        | 125   | 1.9         |

All layers have 1 reinstatement at 100%.

Initial coinsurance for all layers is 25%.

Initial pricing for the layers was determined using a ROL Curve.

There are many potential ways to model changes in reinsurance pricing, taking into account a number of factors including:

- Loss Experience
- Changes in exposure
- Reinsurance Market conditions

The method used here is based on Loss Experience, with exposure and market factors assumed to be constant.

The price of each layer in the reinsurance programme will vary, with an increase in price if the experience account (EA) for the layer is negative, and a reduction in price if the EA is positive and there are no losses in the previous year.

EA = reinsurance premiums and reinstatements – recoveries  
 if EA < 0 then rate = previous years rate + EA \* 10%  
 if EA > 0 then rate = rate \* 90%  
 Initial EA = 0.

This produces a saw tooth shape for reinsurance premium over the years, with premium decreasing until there is a loss, at which point it rises and then decreases gradually over the following years. This produces reasonably realistic looking pricing, and is simple to implement. The exact rate of price increase or decrease can be set to match observed volatility.

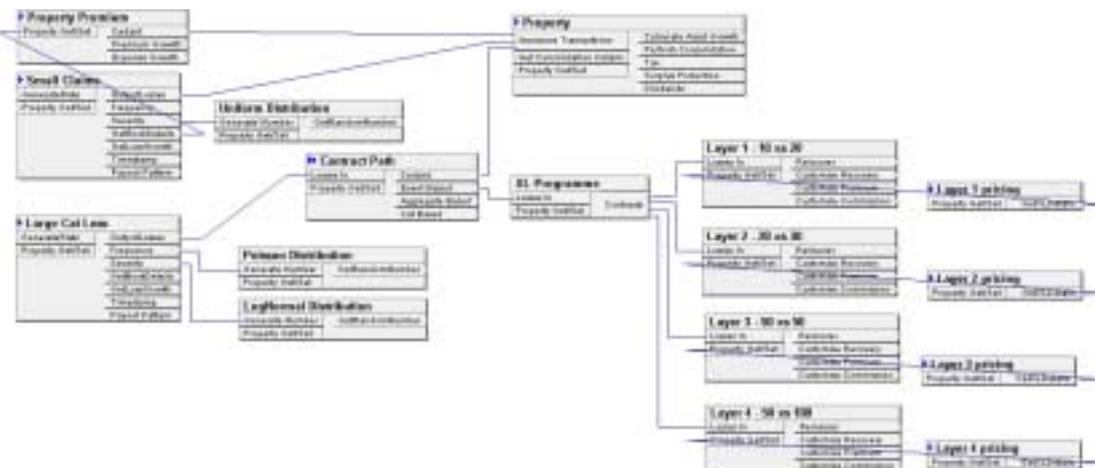
In the constant cover strategy the coinsurance remains the same every year, while in the constant spend strategy the coinsurance varies so that the premium spend remains constant.

The model was built using ReMetrica II – a DFA tool developed by Benfield Greig. ReMetrica II has a number of uses including:

- Risk based capital calculation, and capital allocation.
- Reinsurance Strategy
- Reinsurance Pricing

ReMetrica II is a visual modelling framework rather than a specific model. The user builds up a financial model of the company using a number of different components which are linked together to define the flow of information through the system. The user is also able to build his own components using a language like Visual Basic.

The diagram below shows the model built for this analysis:



The Property book features premium income, expenses, small claims and large Catastrophe losses. The large catastrophe losses are modelled using a compound Poisson distribution with a Lognormal distribution for the loss size. In the diagram above, these losses are fed through an XL Programme and gross losses and recoveries are sent to the Property 'balance sheet'.

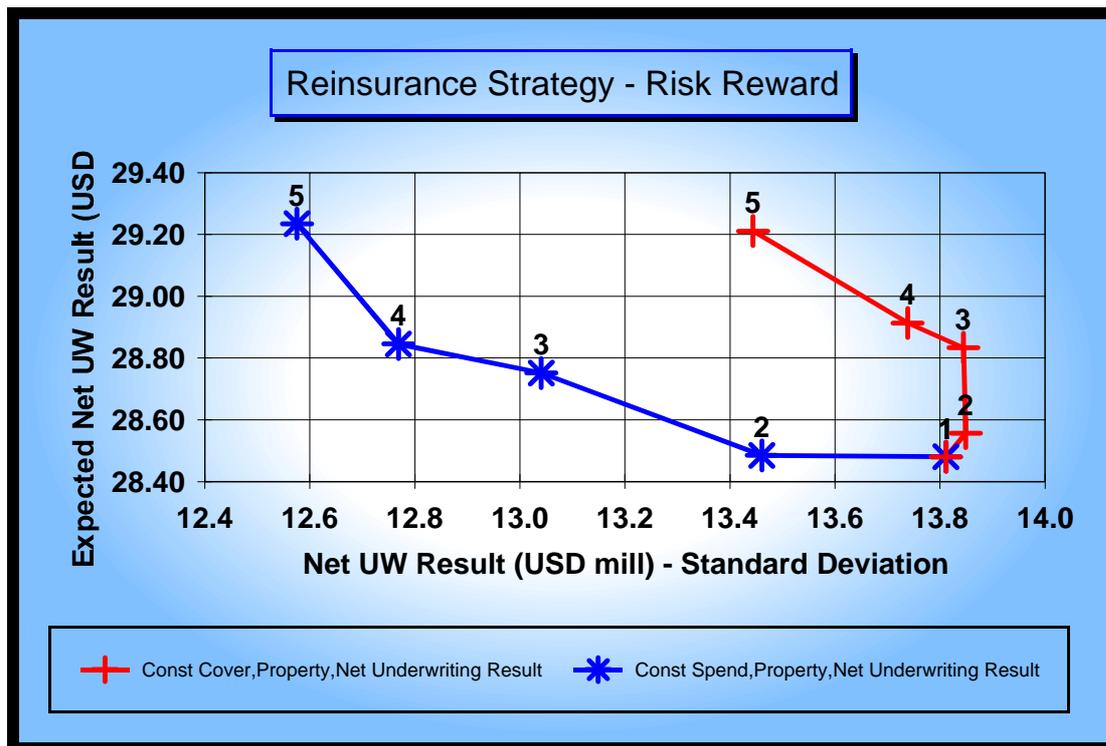
## Results

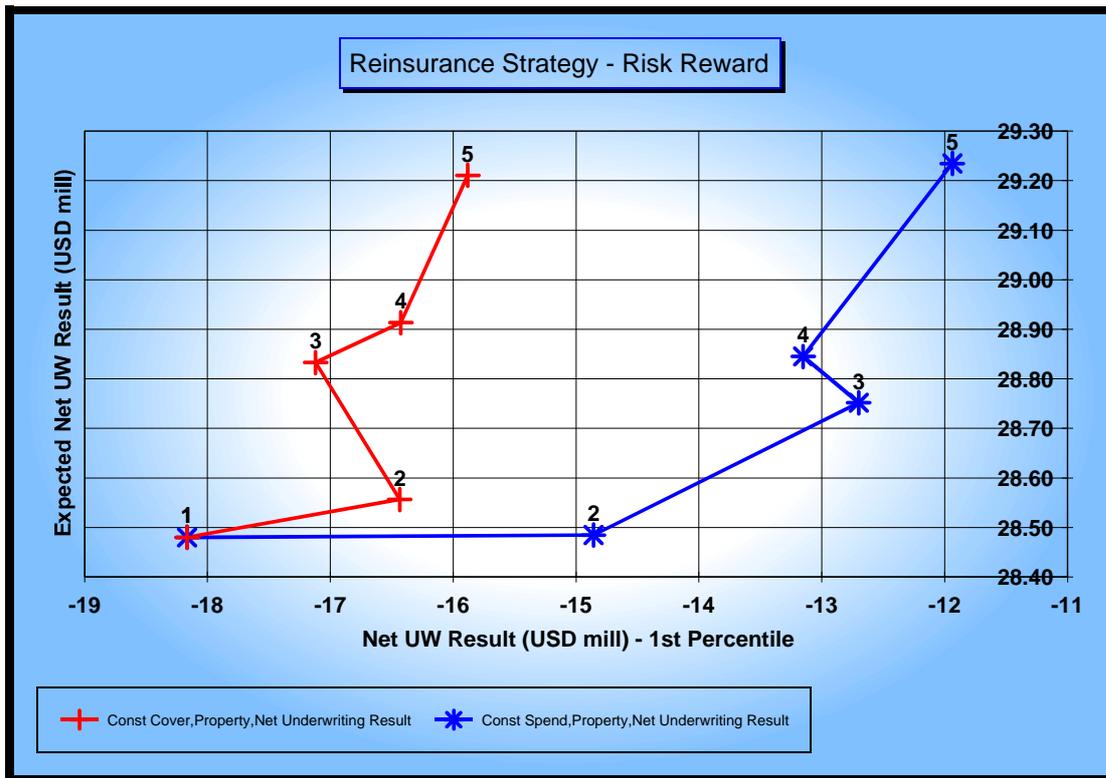
The graphs below show the cedant's net underwriting result. As a measure of risk we show:

- Standard Deviation
- 1 in 100 result
- Probability of a negative UW result

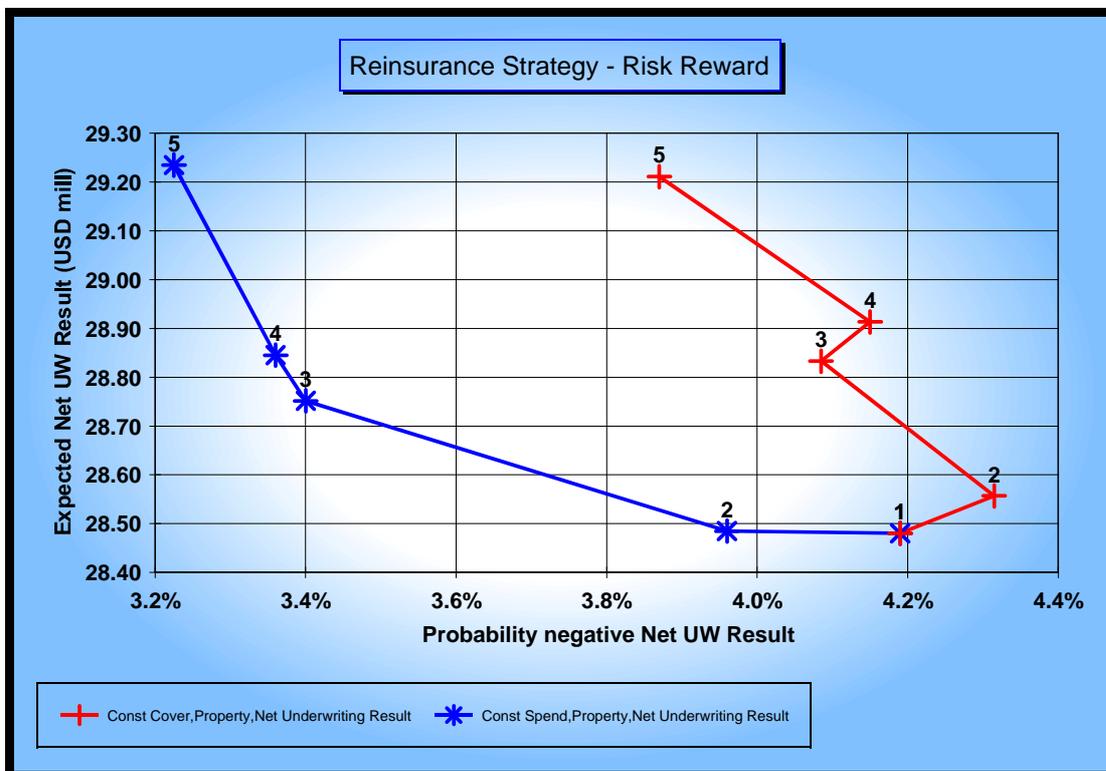
As a measure of return we use expected UW result. The numbers on the graph indicate the years 1 – 5.

### Standard Deviation





Probability of net UW Loss



## Conclusions

The results above show that over a 5 year timespan, a constant spend strategy appears superior to a constant cover strategy.

The difference between the two strategies is quite small but is consistent for the various risk measures. We have performed sensitivity testing of the results for a range of parameters and a number of loss distributions including Pareto, and get similar results for a number of different samples.

The constant spend strategy shown is very similar to an often used real world strategy where the cedant has a fixed budget and buys as much cover as possible down from his PML figure. Other typical real world reinsurance strategies include the constant cover strategy and the 'short memory' strategy. In the 'short memory' strategy the cedant buys a lot of cover after a loss, but if there hasn't been a loss recently reinsurance is seen as a cost and budget reductions are sought.

The analysis indicates that the constant spend approach is superior, and hopefully helps a reinsurance manager defend such an approach to the board.