

Hurricane

FORECASTING STRONGER PROFITS

Hurricanes rank historically above earthquakes and floods as the major geophysical cause of property damage in the US. The annual mean insured damage bill and its standard deviation for hurricanes striking the continental US, 1900-2002, is \$2.9bn and \$6.7bn respectively at 2002 prices and exposures. As a consequence, the US East Coast and US Gulf Coast are among the regions with the highest density of property insurance and property reinsurance in the world.

Insurers and reinsurers have long recognised the strong correlation link (0.72; 1900-2002) between US hurricane activity and insured loss. As a result, it is well appreciated that skilful long-range forecasts of seasonal US hurricane activity could be used either to create an additional profit margin for a seller of reinsurance coverage or to reduce costs for buyers of coverage. However, two facts have taken the edge off the use of seasonal hurricane forecasts in re/insurance business decisions to date. First, Hurricane Andrew – the most expensive insured loss on record, at

\$20.5bn – occurred in a relatively inactive hurricane year and therefore would have been hard to forecast. Second, the correlation between forecasted hurricane activities and insured loss is thought to be too low to be useful, especially at the time of the traditional 1 January renewal.

Several ideas and developments have been combined to demonstrate the business relevance of seasonal US hurricane forecasts for the first time. Foremost is the substantial recent progress made by seasonal hurricane forecasts in terms of lead-time and skill. US hurricane hindcasts

from 1 August (the beginning of the main Atlantic hurricane season) anticipate the correct anomaly sign for US hurricane insured loss in 70% of years, meaning that the high intensity seasons and the low intensity seasons are correctly anticipated in 70% of years. The question is whether this seasonal hurricane forecast skill is high enough to create, through appropriate selling or buying of reinsurance products, either an additional profit margin or a significant arbitrage opportunity to benefit re/insurance business?

A second fundamental premise is to

Niklaus Hilti, Mark Saunders and Benjamin Lloyd-Hughes consider the business application of seasonal hurricane forecasts in property catastrophe reinsurance.

Figure 1: The annual cycle for hurricanes and intense hurricanes striking the US 1950-2002.

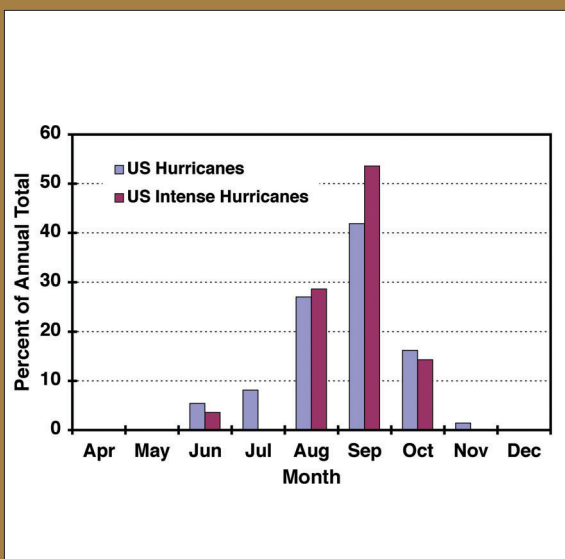
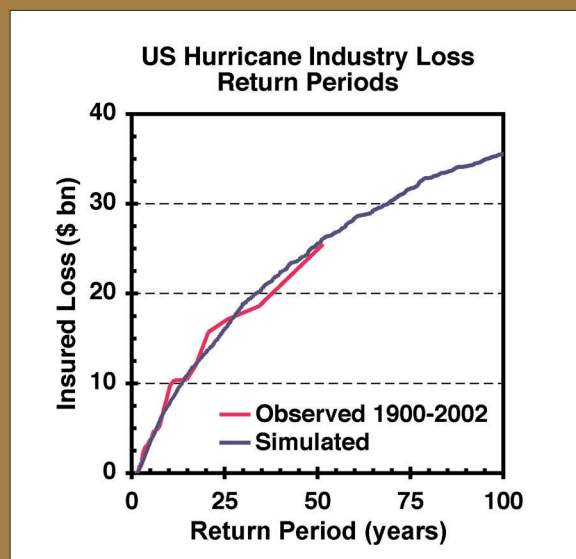


Figure 2: Observed and simulated return periods for US hurricane insured losses (\$bn) corrected to 2002 prices and exposures.



consider the buying or selling of re/insurance covers incepting either at 1 July or 1 August (i.e. in lieu of or in addition to a 1 January renewal). The justification for such a renewal strategy is that 96% of all intense (category 3 to 5) hurricane strikes on the US and 87% of all hurricane hits on the US occur after 1 August (Figure 1). A product which allows the buying or selling of re/insurance covers on 1 August is the Industry Loss Warranty (ILW). ILWs are transparent and simple but standard reinsurance, retrocession or catastrophe bonds may also be applied.

Testing the strategies

The re/insurance business application of seasonal hurricane forecasts has been examined from the point of view of buying or selling US hurricane Industry Loss

Warranty (ILW) covers starting at 1 August. Depending on the forecasted activity for the upcoming hurricane season a decision is made whether to buy or sell ILW reinsurance covers.

Two different strategies are examined:

- Forecast Sell – the strategy of selling ILW cover to create an additional profit depending on the forecast activity for the upcoming season.
- Forecast Buy – the strategy of buying ILW cover contingent upon the predicted activity of the upcoming season.

These strategies have been tested on the 1950-2002 period of historical insured losses (as-if 2002 values) and over a 50,000 year period of simulated US hurricane strikes and losses. The simulation is a sophisticated and complex model which

employs fitted distributions to historical as-if losses and frequency distributions (e.g. Figure 2). This model will be reported in detail elsewhere. In this article only the business benefits from the simulation model are discussed.

The annual profitability of always selling a single \$10m cover with one reinstatement is shown in Figure 3 as a function of forecast US landfalling hurricane activity index and ILW trigger. The net profits are clearly related to the activity forecast index and thus may be predicted in advance of the season. Annual profits for the \$5bn ILW trigger display the largest sensitivity to the activity forecast index with profits in years of low forecast activity (index value of 0.1 to 0.2) being 30% larger than the mean profit, and profits in years of high

forecast activity (index value of 0.8 to 0.9) being 30% less than the mean profit. These results lead to the conclusion that an opportunistic capacity allocation contingent on the seasonal forecast will lead to a 10%-30% increased profitability for a reinsurer selling hurricane ILW cover which follows a Forecast Sell strategy.

The Forecast Buy strategy was benchmarked against the traditional Always Buy strategy where the same amount of cover is always bought irrespective of any forecasts. The reason to buy reinsurance or retrocession is not to make a profit but to reduce the volatility in annual losses. Thus the Forecast Buy strategy was benchmarked by comparing the premium spent per recovery at constant volatility or risk. The analysis was made using different risk measures including standard deviation, Value at Risk and Expected Capital Shortfall, though all gave similar results. The results (Figure 4) show that for a 50-year window a re/insurer pursuing the Forecast Buy strategy pays about 10%-30% less for the same amount of protection (i.e. to have the same recoveries without any increase in volatility or risk). Similar benefits are seen for ILW triggers of \$10bn and \$20bn.

Skillful forecasts

In addition to the property catastrophe re/insurance applications described above, these innovative results offer other business applications. For example, the prices paid for catastrophe bonds within the secondary markets should be influenced by skillful seasonal hurricane forecasts. Also, hurricane forecasts will create an arbitrage opportunity should a new hurricane activity index be developed for trading within the capital markets.

Now the proof is there that seasonal hurricane forecasts benefit property catastrophe reinsurance business, opportunities exist to improve the profitability of a range of hurricane re/insurance products. **GR**

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Figure 3: Annual expected profits from ILW sales as a function of activity forecast index and ILW trigger. The simulation is for 50,000 years.

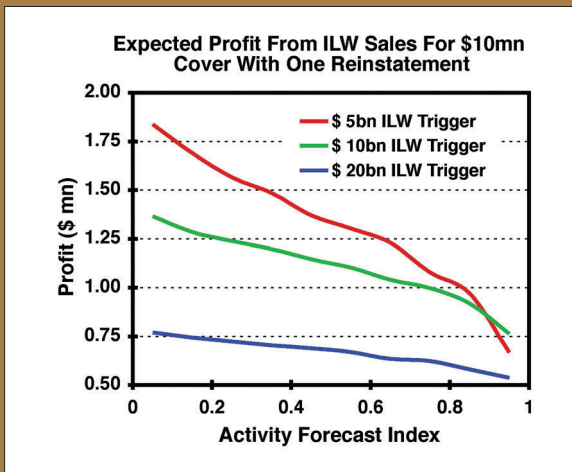


Figure 4: Savings in premium afforded by the Forecast Buy strategy compared to Always Buy for the same reduction in capital risk. Savings are assessed over a 50-year window (repeated 10,000 times) for \$5bn ILW purchase. Error bars show the 10th and 90th percentiles of the premium reduction.

