THE PRICE OF RISK

By John Birkenhead

How insurers price for risk is fundamental to the insurance cover which XYZ is able to obtain and the premiums which it pays. This article considers how insurers 'price for risk' and the specific factors which affect the availability and cost of insurance cover available to XYZ.

Background

The Total Insured Value of large onshore process plants and offshore installations is typically in excess of US$1 billion. This value exceeds the underwriting capacity of any single insurance company. Therefore, the coverage must be shared between a number of insurance companies. Each potential insurer must decide whether or not it wishes to underwrite part of the risk and, if so, at what premium and for what percentage (of the Total Insured Value) it wishes to cover.

The destruction of the Flixborough plant in 1974 proved instrumental in changing insurers' approaches to Onshore (and, to a lesser extent, Offshore) Energy Insurance. The cyclohexane Vapour Cloud Explosion (VCE) at Flixborough resulted in 28 fatalities, over 400 injuries and a property loss of $300 million (in today's monetary values). The fire scenario estimates used by insurers at the time were equivalent to Property Damage EMLs in the region of $50 million (in today's monetary values). As a result a number of insurance companies were significantly over-exposed and made significant losses.

Overall profitability

Like any corporate entity, insurers are in business to be profitable. Thus their income must exceed their outgo. An insurer's income each year broadly consists of premiums and investment income whereas its outgo broadly consists of claims plus expenses. Throughout the rest of this article we explore each of these elements to understand the issues faced by insurers in 'pricing for risk'.

Claims

The claims to be paid by an insurer for coverage in any given year are unknown and potentially extremely volatile from year to year. There is a number of variables which impact the expected claims for next year from a given risk, some of which are shown below:

- *The historic gross (100% ownership) claims experience*
- *The insured's share of gross claims (e.g. 66% ownership)*
- *Changes to the insured's share of risks*
- *Any additions/removals to the insured risk portfolio since last year*
- *Property revaluations*
- *Changes to risk management practice/philosophy*
- *Climatic change (e.g. increase in potential for weather- related incidents)*
- *Updated Estimated Maximum Losses (EMLs) for potential major incidents*
- *Impact of currency movements*
- *Changes in attitude towards claiming (e.g. for employees)*

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With such information, loss scenarios can then be generated, usually with the assistance of the insurer's actuaries.

Typically potential losses will be categorised into high frequency/ low severity losses (e.g. minor injury to a single employee, costing say US$10,000) and (very) low frequency/high severity losses (e.g. a VCE, causing damage in millions of dollars).

High frequency/Low severity Incidents

For higher frequency incidents some past claims data may well be available but the problem will be that many of the claims will be unsettled and therefore uncertainty exists over the final cost to the insurers.

Actuaries sometimes use 'triangulation'-type projection methods to assess how much these existing open claims might settle for in aggregate and how many further claims might be expected to report in the future from past policy years (the so-called "IBNR" claims, "Incurred But Not Reported"). This modelling thus produces a forecast of the total settlement cost to the insurer for these high frequency losses in previous policy years. Typically a range of scenarios would be produced to test the sensitivity of the results to the various input factors.

The forecast settlement cost of historic policy years can then be used as a guide to generating a forecast for the next policy year, modified to take account of changes in employee headcount, Health & Safety procedures, changes in risk management, local legislation and other economic factors. As for past claims, a range of scenarios would typically be produced.

Low frequency/High severity Incidents

(Very) low frequency/high severity incidents are more problematic and subjective to forecast. By their nature there will have been very few (if any) historic incidents; any past incidents (e.g. VCEs) may not have occurred for XYZ, but instead have occurred for competitors or for other installations not directly comparable to the risk profile of XYZ's operations.

Some examples of potential major incidents for XYZ are shown in the table below:

Potential Major XYZ Incidents	
Employer's Liability	VCEs, flash fires, storm, impact
Public Liability	toxic exposures, marine pollution, major incident causing failure to supply customers
Business Interruption	machinery downtime, loss of shipping transportation
Property Damage	major site damage, total hull loss, air/sea impact

EMLs supplied by XYZ are essential in assessing the size of potential incidents and the major perils causing the incidents (e.g. earthquakes), as long as these EMLs are up to date and realistic.

For rare incidents, it is usually statistically the case that the rarest (and hence the largest) incidents have not occurred yet; thus the problem is one of estimating the 'tail' distribution, i.e. the probability that claims exceed a certain (large) threshold, where that threshold may not have been exceeded to date. Such probability distributions for rare events are often actuarially modelled using GPDs (Generalised Pareto Distributions) fitted to the limited historic data. GPDs are an evolving area of actuarial research; inevitably, as more incidents occur, the GPDs are refined to produce more accurate results.

For example, EVT (Extreme Value Theory), closely related to GPDs, can be used to predict very approximately where and when earthquakes might be due. EVT suggests a theoretical maximum intensity of around 8.6 on the Richter scale. This theoretical maximum is supported by current geophysical evidence that earthquakes occurring above this level would release so much localized energy that plastic, rather than brittle, deformation of the surrounding rocks would be caused. Thus current geophysical evidence supports the idea that EVT is of some benefit in forecasting localized earthquake magnitudes. As for GPDs, more data is needed to refine the parameters of EVTs for enhanced forecasting.

Factors external to XYZ

In addition there are issues which are generally outside the control of the insured:

- ***<u>The insurer's existing aggregation risk</u>****: each insurer will already have an amount of risk in similar locations, with similar characteristics and with similar perils as those of the potential insured. Insurers will thus calculate their own EMLs for different perils (such as those listed above) and at different locations allowing for the risks from the potential insured.*

- ***<u>The (re-) insurance available to the insurer for its' aggregate risks</u>****. Insurers take out their own insurance cover ("reinsurance") to protect themselves against excessive aggregations of risks for particular perils at particular locations. Such reinsurance cover will come with its' own terms, structure and cost, which in turn will depend, in part, on each reinsurer's assessment of their own EMLs by peril and location.*

Dependent upon the insurer's existing aggregation risk and its' available reinsurance cover, the type, structure and price of cover to offer the insured (e.g. deductible limits, aggregate limits and other terms) can then be developed using the loss scenarios generated above.

With this estimate of the price of the risk, the insurer will add an allowance for their own expenses, such as underwriting, policy administration, corporate overheads and the handling cost of the expected claims. Allowance may then be made for the potential interest income to be earned, based on the the proposed premium payment schedule and amount and timing of the payment of the expected claims.

Profitability

Finally, like all corporate entities, the insurer will load their premiums for profit, taking account of their overall strategy for certain risks, their desired market positioning and the amount of capital required to underpin the business written. Insurers are risk-takers, risking their own capital to cover claims which exceed the premiums they have charged. The capital owners (usually shareholders) therefore expect a return commensurate with the risk of capital loss, a return typically significantly in excess of the return on risk-free assets such as gilts. The events of 9/11 have focussed corporate insurance minds on the highly volatile nature of underwriting large risks; this has effectively increased the profit margin (or return on capital) required for underwriting large risks.

What XYZ can do

XYZ can help insurers greatly by gathering and presenting a complete "Risk Profile", i.e. its own data gathered, analysed and presented consistently detailing its risks, EMLs, historic claims, risk management systems and corporate profile. With this information XYZ is well placed to demonstrate to insurers its commitment to transparency and partnership with insurers underwriting such large and complex risks.

Summary

Insurers are risk-takers, accepting premiums to cover unknown, but potentially very large, future insured incidents. Insurers have to balance the difficult quantification of the potentially very large cost of unknown future incidents (usually with the limitations of extremely sparse data) and the cost of their own insurance cover, with the corporate need to be profitable and yet offer commercially acceptable premiums as the price for accepting the risks offered to them.

About the Author

John Birkenhead is an independent consulting actuary with 17 years' experience of commercial insurance matters. He qualified as a Fellow of the Institute of Actuaries in the UK in 1995.

He has been the lead actuarial advisor for over 100 clients in the areas of insurance pricing, reserving, management information, data management, risk profiling and insurance product design. He has advised numerous government agencies on quantifying and managing insurance risks, including mandatory earthquake insurance schemes.

He has been the Regulatory Signing Actuary to the captive insurers of a global oil production company, a global technology company and a number of professional indemnity schemes for global professional consulting firms. Previously a Partner in a global actuarial consultancy - where he set up and managed the property/casualty actuarial practice - John now runs his own independent actuarial consultancy.

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