THE RESERVING OF NON-STANDARD CLASSES OF INSURANCE
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Summary

It is not long since the Institute/Faculty produced the new Claims Reserving Manual. This has two volumes describing a large number of reserving methods. However, most of these methods are for standard classes. They rely to a considerable extent on various conditions which are presumed to apply such as:

- Adequate data
- Homogeneity of data
- Regular development of data
- A stable mix of business and types of claim over time
- Absence of calendar year effects on development data
- No abrupt changes in circumstances (legal, administrative, or otherwise)
- Past development of data being a reliable indicator of future development
- Annual policies
- High frequency/low severity

This paper examines a number of methods which can be used for classes of business, or sub-sections of classes, where some of these conditions do not apply. As the methods are designed to overcome similar problems it is likely that the solution to reserving for any other non-standard class can be found by examination of the various approaches in this Paper.

Index

1. Introduction

This paper examines a number of methods which can be used to determine reserve requirements for non-standard classes of insurance, or sub-sections of these classes. In this introduction we will consider firstly the non-standard nature of the classes considered and secondly the types of method used for non-standard classes.

1.1 Non-Standard Features

1.1.1 Low Frequency/High Severity

This also usually implies inadequate data for standard methods, heterogeneity and irregular development. Classes to which this apply are typically non-working layer excess of loss reinsurance (Section 2), and MIPI (Section 7) while New Home/Other Warranty (Section 5) also has low claim frequency with some relatively high severity. However, the low frequency aspect does mean that modelling techniques can be more easily considered.

1.1.2 Calendar Year Effect

The calendar-year effect also implies irregular development of data. Classes, or sections of classes, which exhibit calendar year effects are covered in Section 3 on Policy-Event Based Loss Estimation and Section 4 on Latent Claims. The effect also applies to New Home/Other Warranty Business (Section 5).

1.1.3 Non-Annual Policies

Non-annual policies imply the use of more complex unearned premium reserve calculations as well as claims reserves.

Classes with non-annual policies are "New Home" (Section 5), AESC's (Section 6) and Holiday Insurance (Section 10).

1.2 Non-Standard Methods

The first question to be asked when considering a non-standard class, or any class for which standard methods are not going to work for any reason, is materiality. If the class is very small, or more relevantly if the presumed reserve required is small relative to the company's overall reserves, the considerations are somewhat different. If the class can be sensibly combined with another substantially larger class without unduly distorting the data for that class this might be a valid option, as long as this does not lead to under- or over-reserving for the combined class. Alternatively simple methods based on market averages, such as some of the methods described within Section 4 on Latent Claims might be more appropriate than more complex methods.

The data for a class may be able to be massaged to make it susceptible to standard methodology. Techniques for this are described in 2.2.1 on Excess of Loss Reinsurance and 5.4 for "New Home" policies. Alternatively, the data for a class of business may be made suitable for standard methods by removing part of the data, e.g. by removing latent claims data from general liability classes or catastrophe claims from property classes. This, of course, still leaves the extracted data to be projected, but there may be techniques available such as the latent claims methods, described in Section 4, and curve-fitting or exposure analysis for catastrophe claims.

The types of method described in this paper in increasing order of complexity are:

- Simple methods, e.g. some of the methods described for Latent Claims in Section 4. These may be based on market averages and simple ratios and are used when the required reserves are relatively small, where future development is particularly difficult to forecast, where the data available are inadequate or information is impossible to obtain.

- More complex methods. These involve taking account of the nature of the business either to adjust the data to standard methodology or to produce new methods applicable to the particular class of business. An example is contract-by-contract development for swing-rated contracts (Section 8) in order to more accurately project future premiums.

- Detailed models (deterministic and stochastic). The loss frequency aspect of some of the classes considered make these viable options. An alternative view is that for some classes a detailed model is the only way in which reasonably accurate projections can be made for some classes (e.g. for US Pollution and Asbestos in Section 4 and for MIPI in Section 7).

2. Excess of Loss Reinsurance

Much of this Section is from the paper "Reserving for Excess Layers: A Guide to Practical Reserving Applications" by Ted Dew and Bart Hodges.

2.1 The circumstances involved in reserving for excess of loss reinsurance are distinctly difference from those faced in primary layer reserving. The low-frequency, high severity nature of non-working excess of loss layers creates difficulties not typically experienced in primary analyses. However, the same low frequency nature of excess of loss allows the application of some reserving methods that would be impractical for many primary coverages.

2.1.1 The following list is a non-exhaustive minimal requirement for background information in order to understand the book of business for which reserving is required:

- What types of losses are covered (e.g. third party, bodily injury, liabilities, property damage, catastrophe, etc)?

- What event triggers coverage by the policy (e.g. reporting of a claim to the insurer, reporting of the claim to the policyholder, occurrence of an injury, etc)?

- How do the attachment points and limits respond to a claim, or combination of claims. Are there any reinstatement provisions?

- How does the policy respond to costs spent defending the original insured from lawsuits (i.e. is defence covered within the limits, outside the limits, or covered at all)?

- Are declamatory judgement (DJ) costs an issue (i.e. costs spent defending the insurer in coverage disputes with the original insured)?

- What is the mechanism or series of steps that results in a claim being presented to the insurer?

2.1.2 The following is a partial list of the differences between the primary insurance process and excess of loss reinsurance relevant to the reserving process:

- The claim reporting lag for excess of loss is generally longer, especially for casualty and LMX business.

- Excess of loss policy forms and language vary to a much greater extent. In addition, data grouped by line of business may contain contracts within a wide range of underlying exposures as well as different attachment points and limits.

- The heterogeneity of excess of loss makes it difficult to obtain useful industry statistics. Also, the potential use of additional case reserves necessitates further consideration when applying industry statistics compiled from reinsurers.

- Low claim frequency and high claim severity make the available data more volatile.

- Rating information is less likely to be available.

- Differing reserving philosophies of cedants can create inconsistency in historical data.

- Inflationary effects on attachment points and policy limits may force adjustments to the historical data.

- Sub-dividing data to give better homogeneity will add to the problems associated with low frequency.

2.2 Commonly used Reserving Methods for Excess of Loss Reinsurance

The methods presented below utilise incurred loss data only. In general, paid losses lag incurred losses, but for excess of loss the lag can be very substantial. Delay in claim payments accentuates the leverage problem associated with development techniques. For this reason, additional care should be taken when using paid losses in excess of loss reserving methods.

Several techniques below estimate ultimate losses without directly considering reported losses to the layer. The best use for these methods is often as a priori estimates in a Bornhuetter-Ferguson analysis.

2.2.1 Development of Losses in the Layer

a) The most commonly applied method is the loss development or chain-ladder method, applying expected reported percentages to the incurred losses to a layer. The development patterns determined would be based on a mixture of historical data triangles, representative industry statistics, and judgement

When constructing the development triangle of excess losses the impact of changes to the underlying size of loss distribution should be considered. Over time, the impact of inflation causes the ground-up size of loss distribution to increase, which affects the distribution of excess losses. To account for the impact of trend on the underlying size of loss distribution one method is to use detrended attachment points, i.e. if data are being compiled on losses in excess of £100,000, then £100,000 would be selected as the attachment point for the latest year, say, 1997. Assuming a 10% trend factor the attachment point used to compile data for the 1996 year would be £90,909 (£100,000 / 1.1). For 1996, values of ground-up losses (as at 31.12.96 and 31.12.97) would be compared with the £90,909 attachment paid to determine which claims contribute to the excess distribution. This procedure is then used to determine the claims in each year used to construct the loss triangle. Alternatively, the attachment points can be kept the same (e.g. £100,000) and claims can be inflated, say, to 1997 values so that ground-up claims for 1996 would be inflated by 10% in this example before comparing with the £100,000 attachment point to determine claims to the layer.

It is recognised that this requires individual claims data and assumes a similar business mix over time.

Once the historical data have been compiled the development statistics for the company specific data can be compared to market statistics for a corresponding attachment point, if available, the selected reporting pattern being based on this analysis of alternative factors. When using industry benchmarks it should be taken into account that these are based on development of losses above particular attachment points with unknown upper limits, i.e. with data censored at various limits.

b) A second procedure is to derive a pattern to estimate the development of losses in a specific layer. One such method has been presented by Pinto & Gogol by introducing the formula:

$$LDF_{c,d} = (f(c) - f(d)) / (e_{c,n} - e_{d,n})$$

where $LDF_{c,d}$ = loss development factor to ultimate for losses in layers c to d,

c = excess
d = excess plus limit
f(x) = ratio of losses in excess of x to ground-up ultimate losses
$e_{x,n}$ = f(x) divided by the loss development factor to ultimate, for retention x and month n.

The numerator in the above equation is an estimate of the percentage of ground-up ultimate losses, as of month n. Industry excess loss factors

(ELF's) may provide suitable estimates for f(c) and f(d) or curves may be fitted e.g. of the type $y = ax^b$, using least squares.

For both methods a and b the steps are:

(i) Obtain data for losses above the attachment point and censored at the upper limit

(ii) Determine development factors to ultimate, or percent reported. Either a) selected based on inflation adjusted historical data, benchmarks and judgement or b) derived using the Pinto & Gogol procedure.

(iii) Divide incurred losses in the layer by the percentage reported to give ultimate losses in the layer.

These methods are simple, easily understood and have wide acceptance. However, the result is leveraged due to small percentages reported in excess layers with zero if no claims are reported, and loss data may be unstable or insufficient to construct a data triangle.

2.2.2 Excess Loss Factor (ELF) Methods

ELF's represent the portion of total unlimited losses expected to exceed a specific attachment point usually expressed as a percentage of a specific premium or of total ground-up losses. WCA (Workers Compensation Act) factors are produced by NCCI, although these have a number of drawbacks.

The method may be based on the underlying premiums or on losses, ground-up or estimated from different bases of data, e.g. for a layer $250,000 excess of $250,000:

Using Premium Based ELF's:

$$(\text{Premium}) \times (ELF_{500} - ELF_{250})$$

Using Loss Based ELF's:

$$(\text{Ultimate Loss}) \times (ELF_{500} - ELF_{250})$$

or

$$(\text{Ultimate Loss Limited to \$200,000 per Occurrence}) \times (ELF_{500} - ELF_{250}) / ELF_{200}$$

The advantages of this method are that data at a lower attachment point, or ground-up, may be more stable and the industry statistics may be readily available. The disadvantages are that the data for estimating losses at lower attachment points may not be available, it ignores actual loss emergence in the layer, and is dependent on the accuracy of the base data estimate and the ELF's.

2.2.3 Frequency/Severity Based Method

The basic methodology is the same as for a primary layer, i.e. project an ultimate number of claims and multiply by an average severity, but estimating the number of claims and average size of claim in an excess of loss layer is typically more complicated.

Ultimate claim counts to a layer may be calculated directly using standard development techniques but the volume of claim count data is often insufficient for this. Therefore, the use of a size-of-loss distribution may well be necessary. This typically involves estimating the number of claims in excess of some attachment point (the data limit) below the attachment point for the layer. After estimating the number of claims above the data limit a size of loss distribution is used to estimate the number of claims to the layer. The selected data limit must be high enough to ensure that the detrended data limit for any underwriting year does not fall below the lowest available data attachment point. Using detrended data limits a triangle of claim counts is constructed and, using the chain ladder method, developed to give ultimate numbers of claims.

The next step involves using a size-of-loss distribution to estimate the percentage of claims greater than the attachment point. A single-parameter or two-parameter Pareto distribution might well be appropriate. It is used to calculate the number of claims above the attachment point. Note that allowance should be made for varying primary policy limits in the base data.

The average claim size (severity) to the layers is then calculated based on the fitted size-of-loss distribution. The ultimate loss to the layer is then the estimated frequency times the estimated severity.

The advantages of the method are that it is less dependent on highly leveraged loss development factors and provides insight into the possible driving forces behind the total amount, i.e. by separating frequency from severity. The disadvantages are that claim size count may be unstable, the testing of the size of loss assumptions and curve-fitting may be cumbersome, underlying data may not be available, and actual loss emergence to the layer is ignored.

2.2.4 Difference Method

The difference method is frequently used and is based on the following, typically using the "Development of Losses in the Layer" Method.

Estimated ultimate loss in layer = ultimate ground-up losses limited to the total layer limit
- ultimate ground-up losses below attachment point

The method is simple, acceptable and commonly used. Benchmarks may also be available for the lower limit data. The disadvantages are that it does not directly use the layer data, and ignores the characteristics of the losses in the layer. Also data at lower limits may not be available.

2.2.5 Individual Claim Development

Method A

Individual claims greater than a selected data limit are developed to ultimate, the resulting values being compared to the layer excess and limit to determine the ultimate value of losses in the layer. The method relies on the weak assumption that all losses develop equally.

The first step is to select a data limit below the attachment point for the layer. This permits accounting for claims currently below the attachment point that will ultimately exceed the attachment point.

To analyse historical development applicable to current claims it is necessary to create multiple data triangles. For example, the 1995 year as at year-end 1997 shows a certain number of claims over the selected data limit after 24 months. To develop that specific group of claims, a triangle is constructed which examines the group of claims for each underwriting year that exceed the detrended attachment point after 24 months.

The selected loss development factors are applied to each of the known claims to determine the ultimate value of known claims to the layer. Then a frequency/severity technique is used to estimate the number of claims in the layer still to be reported and the associated average cost. The approach segregates the IBNR into two components: case development on known claims (IBNER) and claims that have not yet been reported that will penetrate the layer.

Depending on the actual provisions for the particular claims being analysed, it may not be necessary to estimate unreported claims, e.g. if there is a specified sunset clause limiting the reporting period or if the policy is claims made.

Method B

An alternative procedure includes the emergence of unreported claims in the development applied to known claims implicitly. This approach requires only a single triangle of amounts over the detrended attachment points at all evaluations. There is then no need to construct multiple triangles or to perform a frequency/severity estimate of unreported claim amounts eliminating a substantial amount of the analysis described above.

The advantages of both methods are that they can produce separate estimates of development on known claims and unreported claims and that they apply the excess layer coverage provisions to individual claim experience. The disadvantages are that they assume no variation in individual claim development and the data required below the attachment point may not be available. Also Method A requires analysis of multiple development triangles, while Method B includes an artificial IBNR provision for each claim.

2.2.6 Simulation Procedure for Individual Claim Development

This method combines aspects of the other projection methods and uses the computing power of current desktop computers. It is a simulation routine that projects multiple alternative scenarios of potential ultimate costs which form a distribution of possible outcomes and hence a distribution of potential reserves.

There are four major steps in the simulation approach:

1) Estimate the number of future claims to be reported. The goal is to estimate the number of claims currently not reported, or with reported values below the data limit, that will eventually penetrate the layer. The procedure differs from that in determining the number of claims in the frequency/severity method in that in addition to estimating the expected number of additional claims reported, an estimate of the variation of potential future claims is required.

2) Estimate the potential ultimate costs for each claim. For current claims, this is done by including individual development factors based on an assumed distribution. For IBNR claims, costs used are projected directly from a loss-size distribution.

   In estimating the distribution of development on current claims, it is important to consider possible correlation of development factors and factors used such as age/maturity, line of business, size of loss, type of loss, etc. It is also important to know how the shape of the distribution changes due to higher/lower average development factors.

3) Apply the coverage details to each loss generated in 2) to determine an estimate of losses in the layer and record the results.

4) Repeat steps 1 to 3 for a selected number of trials to determine a range of results.

The advantages of the method are that it gives a distribution of results, an understanding of input assumptions and the loss process is gained through the research of parameters and an insight obtained into what situations cause certain outcomes. The disadvantages are:

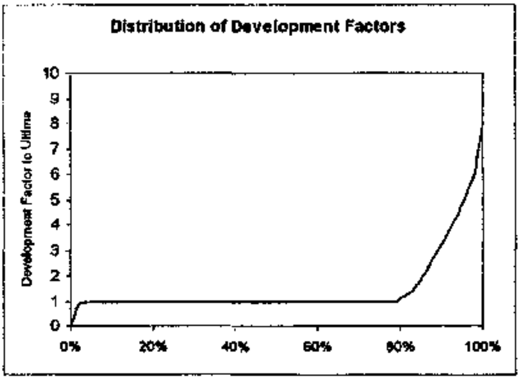
- parameterisation may be difficult and lead to over-complexity or over-simplification

- there may be too much variation for immature years

- needs much more time to perform than other methods

- involves a number of miscellaneous considerations (e.g. selecting a sampling procedure, maintaining confidentiality of claimants, preserving proper relationships between variables, etc).

Note that the distribution for a development factor is as per the following diagram (in this case the mean value is about 1.5). Typically, the majority of claims settle for costs very close to the incurred value, while a few claims deteriorate significantly.



3. Policy-Event Based Loss Estimation

Much of this Section is from the Paper "Policy-Event Based Loss Estimation" by Amy Bouska

3.1 Policy-Event Based Loss Estimation is used for natural disaster loss and latent claims estimation, where triangulation analysis is inadequate. This is the case where:

- There have been few, if any, similar losses in the past and a new type of loss emerges out of nowhere.
- The emergence of these losses tend to be on a calendar-year basis, reflecting elapsed time since the initial event rather than the underlying occurrence
- A lack of correlation between a discrete occurrence and the accounting for the loss.
- Low frequency/high severity.

Examples of PEBLE's are given more explicitly in other sections of this paper, e.g. the models used for US Pollution in 4.2.5 and US Asbestos in 4.3.4.

3.2 Definition of PEBLE

A Policy-Event Based Loss Estimation is any technique which compare event outcomes (e.g. storm effects) with policy terms to estimate potential losses.

3.3 General Description / Loss Events

Basic collective risk models model the claim process faced by an insurer by considering the interaction between the distribution of the number of claims and the distribution(s) of the individual claims and calculating,

$$\text{Total Loss} = X_1 + X_2 + ... + X_N$$

where N = number of claims (randomly selected)
and X_i = cost of claim i randomly selected from a claim size distribution

PEBLEs are a form of collective risk model with 2 stages;

1. A loss event which may lead to an insurance claim
2. Application of individual policy terms to that loss event to determine insured loss.

This is done for all policies exposed using different events to test variations.

A standard collective risk model is used, but with the claim size distribution replaced by the explicit results of the above interaction.

Loss emergence tends to reflect the elapsed time since initiating an event rather than accident year, e.g. number of years elapsed since a TV program was broadcast exposing potential for claims against drug side-effects.

Most models are stochastic which allows for analysis of variability. This is important where there are high attachment points.

Modelling is often complex and may rely on work done outside the insurance industry, e.g. meteorologists, medical experts,.etc.

Where multiple loss events are involved there is a need to consider correlations, e.g. clustering effect with hurricanes, or with liability based losses and successful suits making it more likely for there to be successful future suits.

3.4 Example of Previous Use

Though this approach may appear to be relatively new it was the primary method used to set disability income reserves.

In this case the event module is the known duration-to-date of a disability-inducing event that has already occurred and the policy attributes combining with this are; age at disability, type of contract and elimination period. This is then combined with the net present value of the policy benefits and multiplied by the probability of claim denial to calculate the reserve.

3.5 Issues / Difficulties

Loss potential (frequency and severity) can be affected by exposure. The underlying loss model is likely to incorporate non-insurance expertise; e.g. structural damageability.

Application of loss models to underlying policy terms may be difficult due to the non-availability of required information. Old policy information is often not held in a computer system or in text form.

Loss event modules are frequently based on data developed outside of the insurance industry and deal with types of losses about which there is relatively little information.

This method is reliant upon experts in other technical fields whose advice may be incorrect or biased (and go unnoticed if highly technical).

Current claims information may be an inadequate sample from the universe of possible events.

This type of model tends to be expensive to develop and maintain. Updating the model will be needed where significant changes occur, for example in the types of risks underwritten/policy terms or in the external factors affecting the loss model.

Suitable parameterisation is necessary. This should not be too simplistic, but avoid over-parameterisation. The issue of usability and cost must be borne in mind in developing a model.

The cost of increased accuracy may not be justified by the benefits derived.

3.6 Validation and Usability

- Validation is only possible if losses of the types modelled have occurred.
- Components of the model should be tested separately against individual events and for reasonableness overall.
- Can produce modelled results for a scenario similar to an already known event.

3.7 Advantages of PEBLEs

- Clarity - overall structure is intuitive and easily communicated - analogies to the real world can be made.
- Allows better understanding of the loss process - and hence better management / improvement in the estimation process.
- Scenario testing is possible
- Enables greater understanding of variation.

4. Latent Claims

4.1 Introduction

Many London Market insurers and reinsurers have over the past decades suffered large volumes of asbestos and pollution claims from the United States. The paper "Asbestos and Pollution Reserving Working Party" presented at the 1997 General Insurance Convention focused on these. However, there are various other latent claims which could possibly arrive and should be considered when reserving. A list of the main ones follows but could doubtless be added to. If any of these are considered to be, or will be, materially substantial for a company then they should be considered. The development data should be removed from whichever classes of business on which they impact and reserves should be established for them. In all cases the data are subject to calendar year effects, have irregular development, with past development not being a reliable guide to the future, etc.

In this paper we present the main reserving methods for US Asbestos and US Pollution, which are well-established. Also included is UK Pollution which may be considered as the sort of approach to use for other latent claims where reserves are required.

4.1.1 A general approach is:

- Identify the population at risk, the alleged disease rate and the rate of diagnosis to identify the population of potential claimants. The likelihood of the disease being associated with a product in question and the propensity to sue by a potential client.

- The probability of winning and the likely cost per case and how that would trigger an allocation to policies. Because this model allocates estimated costs to known exposures, it is dependent on the reliability of the coverage information.

Claims can be divided into two types: those where a relatively large number of claims have come through and have been producing significant liabilities (e.g. breast implants) and those which are unlikely events, but where these could be potentially very large exposures (e.g. EMF: electromagnetic fields).

4.1.2 Potential Latent Claims

1. Agent Orange
2. Black Lung (Coal Dust)
3. Silicone Breast Implant

Industrial Chemicals – Carcinogenic:

4. Acrylonitrile
5. Benzene
6. Beta Naphthylamine
7. Dioxins
8. Epoxy Resin
9. Toluene Di-isocyonate
10. Vinyl chloride

11. Diethylsrillboestrol (DES)
12. Electromagnetic Fields
13. HIV Infected Blood Products
14. Intrauterine Devices (IUDs)
15. Lead Poisoning
16. Tobacco
17. Mobile Phones

Agricultural Products

18. Benlate
19. Declonycin
20. Dibromo Chloropropane (DBCP)
21. Pesticides

Other Surgical Implants

22. Silicone/Teflon Implants
23. Heart Valves

Domestic Products

24. Creosote
25. Domestic Herbicides
26. Fluoride in Water
27. Urea Formaldehyde

Hygiene Products

28. Accutane
29. Toxic Shock Syndrome

Industrial Chemicals – General Illness

30. Commadia
31. Mercury
32. Multiple Chemical Sensitivities and Lone Star
33. Sarabond Corrosive Cement Additive
34. Toxic Cloud
35. Trichloroethylene

Medical Products

36. Achromycin
37. Flagyl
38. Oraflex/Opren
39. Tetracycline
40. Vaccine Claims

Other Lung Diseases

41. Arrophic Rhnitus
42. Berylliosis
43. Byssinosis
44. Celcon Pipe/Techrite Piper
45. Mucus Membrane Disease
46. Petroleum Coke Dusts
47. Silicosis (Sand Blasting)
48. Talcosis
49. Welder's Lung

Pregnancy & Birth Products

50. Benedictin
51. Delalutin
52. Estrogenic Compounds
53. Foetal Alcohol Syndrome
54. Oral Contraceptives
55. Pitocin
56. Thalidomide

Repetitive Strain Injuries

57. Beat Elbow/Knee
58. Repetitive Stress Injury
59. Tenosynovitis
60. Vibration White Finger

Stress-Relieving Drugs

61. Halcion
62. Prozac
63. Xanax

Workplace Hazards

64. Industrial Asthma
65. Nilever
66. Noise Induced Hearing Loss
67. Radiation
68. Radiation Cataract
69. Spondylitis

70. Video Display Units

4.2 US Pollution

Much of this Section, and Sections 4.3 and 4.4, are from the Paper "Asbestos & Pollution Reserving Working Party" from the 1997 General Insurance Convention.

The following are possible techniques which are used to determine reserves for US Pollution.

4.2.1 Company Market Share

Estimates are required of the total US pollution liability to the insurance industry, preferably split by year (or bands of years) that it is likely to impact insurance coverage. The company's share of the total in each time period can then be estimated by taking the company's proportion of total premium income (from policies that will be impacted by pollution liability) during the period. Adjustments can then be judgementally made for the company's exposure characteristics compared to the industry average, such as whether it wrote high or low.

.2 Multiple of Current Payments

Assuming that the company knows what it has paid in pollution claims over the past few years, then benchmark survival ratios can be used to multiply these payments to produce a reserve. Footnote 24 disclosures published by BestWeek suggest that the average survival ratio for the US insurance industry was around 10 as at 31 December 1995. Allowances can then be made for whether the company is a relatively high or low layer writer, or has a relatively higher proportion of inwards reinsurance and retrocession business than average. Allowance may also be made for any unusual patterns of recent payments, for example if the company has been settling with many of its assureds.

4.2.3 Multiple of Case Reserves (or Reserve Potentials)

The claims department should be able to provide claims reserves and it is possible to apply an IBNR multiplier to these. Many of the assumptions required to estimate an appropriate multiplier will be similar to those used in the aggregate loss projections (see next method). Consideration should also be given to any perceived caution in the case estimates. Alternatively benchmarks or rules of thumb may be available from other companies or consultants. However, such peer group benchmarking will eventually lead to overfunding, as IBNR drops as a proportion of outstandings.

4.2.4 Projections of Aggregate Paid Losses

One of the reasons why traditional actuarial methods fall down is that pollution claims develop on a calendar year basis. However, it may be *possible to project aggregate payments by calendar year. A payment pattern* needs to be derived and a possible approach is to analyse site discovery dates, combine this with a projection of future site numbers and an estimate of relative site costs by year of discovery. A further refinement would be to split out the elements of cost (e.g. clean-up costs, litigation costs) and project these separately for a site discovered in a given year, applying weightings to each cost type by year of site discovery.

4.2.5 Build a Model

The largest problem likely to face a company wishing to explicitly model its potential liabilities from US pollution is obtaining suitable data. Even if suitable data exists, the time required to make all the sources consistent (which is likely to require judgement) must not be underestimated. This paper does not discuss the critical issue of data collection and cleaning.

The rest of this section looks at a possible model for direct insurance in general terms. It assumes that everything will be modelled explicitly. In practice only certain components are likely to be, with other amounts added on as bulk loads (grossing up) at the end of the process.

The following bullet points list the main items of data which will be required for the model. Other data may also be useful, and it may be possible to proceed without all the fields mentioned below. The main source of information is likely to be the company's claims department although other sources may be used to supplement this information.

- *site information* including name and code (to avoid duplications and allow further investigation), cost estimates (all on one basis, preferably undiscounted best estimate), location, site type, proximity to water sources (to aid natural resource damage estimation), proximity of population centres (to aid third party liability estimation).

- *policy information* including start and end dates, attachments and limits (preferably from the ground up and may be separate limits for bodily injury, property damage or combined single limits), exclusions, treatment of expenses and company line on the policy. Note that ideally the entire coverage chart is required for each assured (i.e. the other insurers' policies as well) so that alternative allocation methods can be tested and the treatment of defence expenses modelled properly. However, this information is unlikely to be widely available.

- *assured information* in particular a definitive list of assureds to avoid duplication and also knowledge of corporate history is essential in order to allocate losses to the correct policies.

- *involvement information* including start and end dates of involvement, types of involvement (e.g. transporter of waste, generator of waste), whether the assured owns the site, the share of the costs to be borne by the assured and the state law that is likely to apply (not necessarily based on location of the site).

The first stage of the model will be to fill in any blank data for the known sites, policies and involvements. If a large proportion of each field is populated, it should be possible to fill in the gaps based on distributions of the data that are available. If not, other external information may be available to assist.

Judgements must be made as to whether the data that are held are of sufficient quality and whether these data are a suitably representative sample for filling in the blanks. Questions such as 'has the claims department only completed the site costs for the biggest sites?' must be resolved. Different distributions will be appropriate when estimating the site data which are not present for NPL and non-NPL sites.

One issue that the model builder must face is whether the model should be deterministic or stochastic. A deterministic model, for example filling in blank records with an average amount in all cases, will not model reality. The 'spikiness' of real claims will be lost, which may have a dramatic effect on the distribution of liability from one layer to another. A stochastic model allows this spikiness to be modelled.

The next stage will be to generate IBNR sites and involvements. The market level analyses are a useful starting point for estimating the ultimate number of sites. Distributions of site costs, number of involvements on each site and shares of sites will also need to be estimated. This process will inevitably be highly judgmental. Many commentators believe that the big sites will have been reported first, leaving relatively smaller ones for the future (often referred to as 'barrel scraping'). Also future clean-up costs may be affected, among other things, by different clean-up standards in the future (e.g. through Superfund reform), different technologies altering the costs or a different distribution of PRP/EPA led clean-ups.

The emergence of new insureds, and hence new policies, must also be considered. However, when attempting to arrive at an aggregate amount (as opposed to best estimates at the insured level), it may be appropriate to allocate all IBNR involvements to known insureds to avoid the complication of generating phantom policies.

Allowance must then be made for the other elements of cost which may form part of a claim. A straightforward loading for the clean-up costs may be appropriate for some elements such as natural resource damages. Other elements, such as defence expenses, which have very different effects on primary and excess policies, may need to be modelled in more detail. Other costs, such as expenses to be incurred in creating case reserves, may be projected separately outside of the model.

The model will require a trigger and allocation routine. A relatively simple routine may be built which allocates all costs on a continuous basis between the start and end dates deemed to be appropriate. A more sophisticated approach could be used.

When attempting to model pollution liabilities, it is necessary to allow for the fact that the claim against an insurer may be dismissed by a court. Hence a set of win factors will need to be developed. To be as accurate as possible, the following will need to be factored into the win factors:

* year in question
* applicable state law
* defence likely to be used
* how to allow for multiple defences.

The model will also need to have the flexibility to be able to apply win factors before or after applying losses to policies, depending on the situation being modelled. This may result in a very different allocation of losses between high and low layer policies. Different applications of the win factors may reflect the allocation of losses to policies if a case is litigated to conclusion or alternatively if a case is settled prior to any court decisions.

Allowance for future settlement strategy may also be built into the model. An analysis of settlements to date may reveal whether settlements achieve a better or worse net present value than litigating to conclusion, i.e. whether there is any economic gain in excess of discounting for the time value of money when settling. The future volume of settlements may have a dramatic effect on the results if there is a significant economic gain or loss from settling (as opposed to litigating).

Rather than trying to model everything explicitly, it may be decided to only model a part of the liabilities and then to gross up for other elements. For example, current NPL sites may be the only element in the explicit modelling (perhaps due to data quality, alternatively due to data volumes), with IBNR

NPL costs, all non-NPL costs and all non clean-up costs loaded on at the end of the process. Other variants are also possible.

Settlements which have been made prior to the reserving date must also be allowed for. If a full settlement has been agreed with an assured (for example, all the policies have been bought back), then it is probably easiest to remove that assured's policies from the exercise. Partial settlements (for example specific site releases) also need to be allowed for in an appropriate manner. If the reserves are to be used to go into a balance sheet, the exact timing of settlements needs to be taken into account to ensure that assets are consistent with liabilities.

One final point to note is that no matter how sophisticated the model and how clean the data lying behind it, the answers produced are still, at best, an educated guess. However, by altering parameters within an explicit pollution model (i.e. sensitivity testing), some view may be formed as to a reasonable range of estimates.

The first four methods listed above should all be achievable with considerably less effort than the last. However, they are highly subjective and people carrying out the estimation may find themselves facing questions like 'shall we use a factor of 2 or 3'? which alone may add 50% to the liability. Therefore, alone, they may not be sufficiently robust for a company with material pollution liabilities, whereas they may be justifiable for a company with a small pollution problem.

Explicit modelling of the liabilities will allow the company to carry out sensitivity tests on the drivers that affect the pollution liability, such as numbers of sites, different US court verdicts or different allocation methods. A model can also be used to link to any asset liability work that the company may undertake, for example linking via inflation. Having a model may also be useful for assistance with commutation work. In these circumstances, good data may be at hand for the specific assured or cedant which will be easy to 'plug into' the reserving model.

In an ideal world, a company would model its liabilities explicitly and then use alternative methods as benchmarks against which to test the model output for reasonableness.

4.3 US Asbestos

As with pollution claims, traditional actuarial techniques based on triangulations of claims data cannot be used. There are many reasons for this including.

- claims are spread over a number of policy years based on the applicable trigger theory. Thus there will be strong calendar year effects in any triangulation. Claim development is not dependent on the age of the policy.

- both historical and future claim development will be distorted by the effect of the aggregate limit on products coverage.

- asbestos related diseases are latent for many years.

However, there are a number of techniques which can be used to estimate future asbestos claims for direct insurance. The main techniques used are as follows:

4.3.1 Multiple of Current Payments

The required reserve is estimated as a multiple of the average claims paid over the last three (say) years. Footnote 24 information published by BestWeek gives some helpful indicators on possible multiples to choose. As at 31 December 1995, the reserves of US insurers for asbestos claims represented a survival ratio of 9:1. The reserves established by US insurers of $11.2 billion represent approximately half of the discounted reserve requirement based on ultimate losses of $40 billion.

4.3.2 Multiple of Case Reserves

This method simply derives the IBNR reserve as a multiple of case estimates. As with the multiples of current payments described above, the multiples will need to be adjusted to reflect the level of writing and the mix of direct, reinsurance and retrocessional business. It is a little more difficult to obtain benchmark multiples of case reserves from published sources.

BestWeek reported that Footnote 24 disclosures implied that case estimates for asbestos claims represented 61% of total asbestos reserves as at 31 December 1995. This would imply case estimates of around $7 billion. If we use an ultimate estimate of $40 billion then the undiscounted IBNR requirement as at 31 December 1995 is around $17 billion representing around 250% of outstandings. Furthermore, BestWeek expressed considerable concern about the correctness of insurers' declarations of case reserves.

4.3.3 Projection of Aggregate Paid and Incurred Losses

Another relatively straightforward possibility is to project the aggregate paid or incurred development for all policy years combined. An assumed payment pattern could be derived from the projections of individual bodily injury claims undertaken by a number of research organisations such as Stallard and Manton. Adjustments would need to be made for the delay from the date of diagnosis to the date of claim payment and the effect of the limits and excess points on the business written.

Such patterns can also help to estimate the effect of discounting on the claim reserves.

4.3.4 Using a Detailed Model of Asbestos Claims

Detailed modelling of asbestos claims is in principle fairly simple. The ground-up losses of each asbestos defendant are projected. The effect of these ground-up losses on the insurance or reinsurance policies written are then calculated. However, whilst in conceptual terms this process is straightforward, in practice there are often significant difficulties due to a number of factors including:

* The level of detailed policy information required is often not fully available. This is particularly true for reinsurers who are often not aware of the policies written by their cedants. In order to calculate the effect of the ground up losses for each defendant, details are required of the cover provided by the direct insurer and the cover granted by the reinsurer.

* The complexity of the insurance and reinsurance arrangements.

* Uncertainty surrounding the allocation of the insured's claims to policy years.

* The limited availability of information on the ground-up claims development for some cedants.

If the required data can be obtained, projection of the ground-up claim for each insured and calculation of the effect of these claims on business written should produce a more reliable estimate than the other methods described above. The model allows explicitly for coverage provided by the insurers or reinsurer together with the underlying claim development of the insureds.

The most detailed description of an asbestos model of the type outlined above which has been published to date was set out in the paper "Measurement of Asbestos Bodily Injury Liabilities" (Cross & Doucette 1994). Cross & Doucette describe how the difficulties caused by the absence of detailed policy information can be overcome if complete information is available for a sample of the business written. They use the results of the detailed projections for the policies for which full information is available to estimate the liabilities for the rest of the account. The main steps in the modelling process outlined by Cross & Doucette are set out below:

a. Collect details of the policies written by the company which are potentially exposed to asbestos claims. This information should be available within the company and should include names of the defendants involved. In practice, only a sample of the policies may be considered in order to reduce the volume of work.

b. For reinsurance business, it is necessary to seek details of the business written by the cedant. It is at this stage that it is often most difficult to obtain data as the only reliable source may be the cedant itself.

c. Using the information on the defendants covered a selection of a group of defendants to be modelled in detail will be made. This selection will be based on the size of the company's exposure to each defendant and the availability of data for each defendant. In order to ensure that a good cross section of defendants is chosen and to assist in the extrapolation of the results to defendants outside the chosen group defendants are classified into five tiers. The major manufacturers or suppliers of asbestos products who are expected to face claims exceeding $1 billion are included in tier 1. The second tier is smaller producers and distributors. Tier 3 includes local and regional distributors of asbestos products whilst tier 4 defendants have rented or owned property where asbestos produces are used. Tier 3 and 4 defendants have been brought into the asbestos litigation as third parties. Tier 5 is railroads which suffer claims under FELA from workers exposed to asbestos. This analysis by tier is important because the development pattern of claims for defendants will differ between the tiers. In broad terms, the claims for tier 1 and tier 2 defendants would be expected to be more developed than those from tier 3, 4 or 5 defendants.

d. Collect information on the claims filed with each defendant chosen for detailed modelling. The required information includes details of claims filed, claims payments, expense payments, insurance cover and coverage disputes. This information can be difficult to obtain for some defendants. However, possible sources of data include the claims department of the insurance company, annual reports of the defendants, lawyers acting for the insurance company and court documents.

e. Project the future development of asbestos claims for each of the chosen defendants. These projections often involve the application of a latency profile to the exposure profile for the defendant. Fortunately, full details of such projections are often publicly available as they have been used as evidence in bankruptcy proceedings.

f. Allocate the claims for each defendant to each policy year. In some cases the allocation basis will be known. There are a number of possible assumptions which can be used if the allocation basis is not known.

g. Restate the policies written by the company on a ground-up basis for the original insured. This is a mechanical process if full details of the business are available. For a primary or excess insurer this is likely to be a straightforward process. The process is more complex for reinsurers as allowance will need to be made for the effect of the risks written by the direct insurer. For example, if the direct insurer wrote 50% of a layer of $10 million xs $10 million and the reinsurance provided the cedant with cover for 20% of $1 million xs $3 million then the reinsurer's exposure ground-up terms is 10% of $2 million xs $16 million.

h. Calculate the effect of the projected claims from steps e. and f. on the restated policy data for step g. Care is needed to ensure that the treatment of expenses is consistent with the policy conditions.

i. Extrapolate the results for the selected sample policies to the rest of the account. As discussed above, this extrapolation will need to be undertaken for each tier separately. There are a number of possible methods of extrapolation.

j. Examine the sensitivity of the results to the assumptions made in the model. The key assumptions are likely to include the rate of claims cost escalation, the ratio of expenses to indemnity payments and the method of allocating a defendants' claims by policy year.

4.4 UK Pollution

Reserving for UK pollution claims is at a very early stage of development. There is a lack of any publicly available papers which suggest a possible approach. This is not surprising given the considerable uncertainty surrounding both the size of the clean-up costs and the extent to which such costs may be covered by insurance.

One way in which the possible size of insurance claims for a given company could be considered would be to drill down from market level estimates. The steps in such a process may be as follows:

- Decide on an estimate of the total clean-up claim for the UK. This could be based on the CBI estimates suitably adjusted for the expected number of hectares to be remediated. Additional loadings may be added for defence and other legal costs associated with any clean-up.

- Choose an assumed proportion of the clean-up costs which may be potentially covered by insurance. Reduce the proportion to allow for the fact that not all potential insureds will bring claims and that insurers may be able to successfully defend some claims. Multiplying this proportion by the total clean-up costs gives the insurance industry costs.

- Estimate the company's likely share of the claims from information on its market share for public liability, the type of risks covered, use of pollution exclusions etc. Multiply this share by the insurance industry costs to obtain the company's possible claims.

This type of "top down" methodology can also be used for other types of claims (such as some health hazards) in order to get a rough handle on the potential size of a problem.

Unfortunately, at this stage most of the parameters for such a process applied to UK pollution would be guesswork.

4.5.1 Reinsurance and Retrocession of Latent Claims

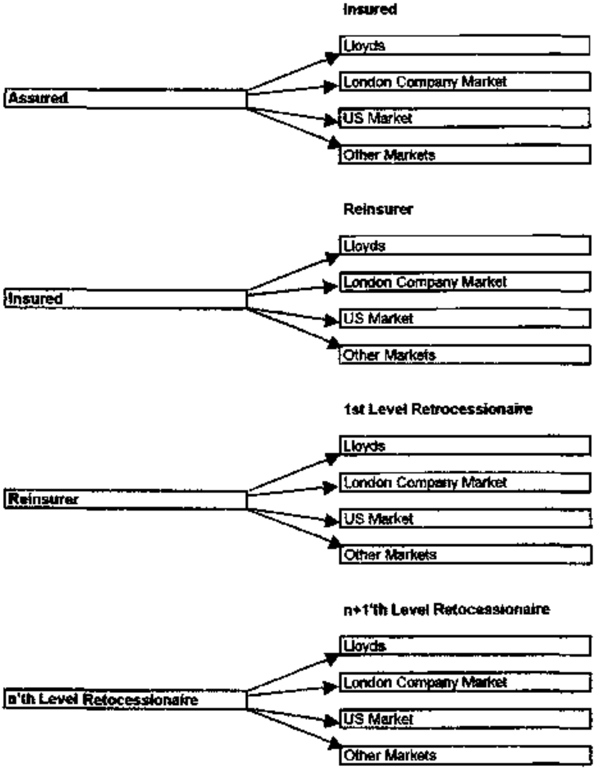
For both US, Asbestos and Pollution methods similar to those outlined above may be used. For the modelling approach if coverage charts are available for core assureds these can be used to directly model gross losses for the US cedants, grossing up for unknown losses. Details of reinsurance programmes for the core cedants are required to enable modelling of reinsurance recoveries and amounts placed in the London Market. For other US cedants a grossing up exercise is required based on estimates of amounts placed in the London Market. Allocation to a London Market company would then be based on share of the market (e.g. by premium/year or incurred claim/year).

For retrocession, a modelling approach based on reinsurance and retrocession programmes cannot be used because of the complexity of the programmes. One approach that can be used is to start with the total presumed market insured loss (e.g. for US Asbestos or US Pollution), possibly broken down into groups of underwriting years.

The share going to each market (Lloyd's, London Market, US Market, Other Markets) is determined from market knowledge (brokers, claims managers, underwriters, etc). At each further stage the amount retained is estimated then the share of the amount reinsured to each of the markets is considered, and this is tracked through until the level of retrocession at which the amounts are considered to be negligible. For a particular retrocessionnaire the amounts are then allocated on a market share basis.

The following diagram shows the flow-chart envisaged with the number of cells multiplying by 4 at each level, although a loop can probably be used after the second retrocessional level as the percentages retained and allocation of retrocession from each market to each market would probably be fixed.

Flow of Insurance/Reinsurance/Retrocession by Market



5. "New Home" and Other Similar Warranty Policies

5.1 Introduction

In the UK this type of policy for a new home typically has a term of 10 years, though some other policy durations do exist. The policy duration is the most unusual aspect of this class of insurance.

5.2 Cover

Without going into too much detail, these warranty policies cover a "new home" owner against major structural defects occurring within the term of the policy.

5.3 Claims Experience

5.3.1 Run-off Period

Claims arising from these policies must be reported within the term of the policy, typically the first 10 years. However, processing these claims in the past has, in some cases, been quite lengthy, especially when either the original repair works fail, or disagreements occur with regard to validity.

Although long drawn out cases are the exception rather than the norm, it still nevertheless means that there are outstanding liabilities even after some twenty years. As one can imagine, many changes in the risk can and do occur over this period of time. Some examples include changes in weather patterns, changes to minimum building standards and specifications, policy coverage and the more general items such as inflation, which can be quite significant over this sort of duration.

5.3.2 Frequency

Typically, the frequency of claims is relatively low when compared with most personal lines business, less than 5% over the whole term of the policy compared with motor and household insurance which are roughly 25%. Whilst one might conclude that this means new homes are generally well built or claims difficult to make, it does not provide much information with which to project future claims costs, especially considering the term of the liabilities.

5.3.3 Cost

Though the claims costs on any one policy are usually less than £5,000, they do sometimes run into hundreds of thousands, particularly for an expensive house for which severe defects can occasionally require the home to be demolished and rebuilt.

5.4 Reserving Approach

One relatively simplistic reserving method used fairly widely for this class is described below.

Policies are generally split by underwriting year and policy type. For example, policies on "new builds" are analysed separately to policies on "conversions".

The actual claims analysis itself looks at frequency and average cost per claim separately.

5.4.1 Frequency

Claims information is summarised in the usual triangular form and a model not dissimilar to the Chain Ladder is used. However, due to the unusual nature of this business it is first necessary to "remove" calendar year policy generation effects.

To do this a form of minimum error estimation is used, in which generations are grouped based on conditions at the time of writing (i.e. building standards) and generation and calendar year factors are calculated which minimise the minimum error estimator.

Once this has been done the data can then be "normalised" using these adjustment factors, and an average runoff pattern calculated.

Though it might be argued that this approach to some degree gives spurious results, the effect of having very limited and quite variable data from year to year means that there is little else which can be done other than calculating simple averages over calendar years, generations and by policy duration.

Once the initial results are obtained and combined to give basic frequency projections, other adjustments are made to allow for other factors which are likely to affect it in the future. For example, changes in the political and legal arena and new elements of cover introduced on existing policies since inception.

5.4.2 Average Cost

As with frequency, information is summarised in triangular form by year of inception and policy duration. This information is then further split by broad category of claim to try to increase homogeneity. However, this is only possible to a very limited extent due to the very low claim frequency.

Various averages are calculated and trends identified for each of the homogeneous groups of claims and projected splits between the types of claims estimated, then both are combined to estimate the overall expected basic average cost per claim by generation and policy duration calculated.

Again, as with the frequency estimates, the estimated average costs figures are adjusted for inflation and future uncertainty.

5.4.3 Overall

To obtain overall reserve estimates the frequency and average cost estimates are simply combined by generation and policy duration before totalling across all policies.

5.4.5 Summary

Essentially, the effect of having only limited volumes of data means that the approach above is limited to applying only fairly simple statistical techniques in order to obtain starting estimates. The second stage of the process is to identify any further (unusual) trends, which are then allowed for in the final estimates.

In order to strengthen confidence in the results, a number of different splits and averages are taken and results compared. The benefit of this is to both act as a cross-check of each set of results and to help explain the reasons for any differences.

Stress testing the final estimates under different sets of assumptions is also used to ensure that the reserves are appropriate under different circumstances.

6. Automobile Extended Service Contracts

6.1 Introduction

Automobile Extended Service contracts (AESCs) provide cover to the insured for the costs of mechanical breakdown for items not covered under normal warranty insurance cover, within a specified period (expressed in terms of mileage and/or time). More specifically, the cover may be on a "bumper to bumper" basis or "powertrain" (i.e. everything or engine + transmission + differential or trans-axle). Insurance coverage is structured in one of two main ways: either the purchaser is the insured (with the dealer acting as agent) or the agent insured for the contracts it arranges. Insurance in both cases covers the cost of the dealer repairing the vehicle.

Premiums are often retained by the agent for a considerable period of time. Cover is often for a period greater than one year and may not incept immediately the policy is taken out. Hence there are problems when calculating earned premium reserves.

6.2 Insured Risks

Due to the nature of this type of insurance the risks covered can vary in a number of ways. This includes different mileages and durations, as well as different car makes and models, whether cars are new or used and the dealership involved.

6.3 Claims Experience

Since coverage is for physical damage to the vehicle and claims are both reported and settled quickly, reserves are not generally believed to be significant. However, without the consideration of premium flow this reasoning can lead to disastrous results. With this type of business the rate at which premiums are earned can have a significant impact on loss ratios. Furthermore, the unearned premium reserve is likely to represent the most significant part of total reserves.

6.4 Approaches to Reserving

Though claims experience is likely to vary considerably depending on the category of insured risk, it is not likely to depend materially on policy duration or maximum mileage factors. This means that additional stability in any analyses can be gained by aggregating across several policy terms.

A factor likely to be of greater importance is the administrative structure of any particular programme. For example, some require pre-authorisation of repairs over a certain value, some require this for all claims. This type of feature will clearly be much more difficult to allow for in claims analyses.

6.4.1 Aggregate Approach to Loss Estimation

Rather than calculating reserves separately for unearned premiums and outstanding claims it is possible to take a more unified approach by using projections organised by policy period to calculate expected ultimate losses. The effect of this, however, is that the delay from inception to all claims being settled can be two or three years beyond the policy duration.

The tail can be shortened slightly by considering separately the lag from policy inception to claim occurrence and from claim occurrence to final settlement. Here the lag will be reduced by the length of the initial period, which also has the advantage of separately investigating the two different elements of lag.

One significant item for which allowance needs to be made is the effect of changes to the manufacturers' warranties which, since their respective cover is excluded from the AESC cover, has a clear impact on the ultimate liability.

6.4.2 Bornhuetter-Ferguson

Another approach which is sometimes used is one derived from the Bornhuetter-Ferguson method, using adjusted, trended pure premiums based on development factor projections rather than loss ratios as initial estimates.

6.4.3 Where There are Limited Data

The most desirable course of action in this situation is to **recast existing data** which are available for other warranties, in order to create a dataset for the new scenario. For example where the manufacturer warranty has changed, existing claims information has to be adjusted to allow for this.

Where the data available are too sparse it will be necessary to develop estimates of future claims experience from other sources. One approach is to use **Monte Carlo Simulation** to model the interaction of various aspects of AESC and estimate the timing of loss emergence (e.g. contract term in miles/ time, cost of repairs by mileage and effect of manufacturer warranties on costs).

Mileage is randomly generated per contract and total claims costs estimated. This is carried out for a large number of contracts to determine the expected loss pattern from which substitute development factors may be generated.

Clearly the model for annual mileage should not treat year on year mileage for any vehicle as independent, as the figure for one year is likely to be similar to that for future years.
Where there is substantial experience over too few years then problems arise in that the information to date cannot be ignored. However, as it stands it does not extend over a long enough time period to be fully relied upon. In these cases Monte Carlo can still be used, but the approach should include testing the models used for appropriateness against the real data already obtained.

Where the data produced by the model are similar to the real experience then the model can be used to estimate the tail for immature policies. However, where there are substantial differences then these must be explored and understood and then the model adjusted accordingly.

7. MIPI: Minet Accountants Lineslip

The Minet Accountants Lineslip covers the big accountants for professional indemnity.

It is a complex programme with substantial changes in constituents, areas and programme structure each year.

The accountancy firms each have their own deductibles per loss and in the aggregate with possibly separate cover and values for different areas of the world, with various complications such as stepped deductibles. Above these retentions the MIPI programme operates with typically stacked layers with aggregate limits (or limited resinstatements) and possibly aggregate deductibles. The layers are expressed in the familiar way, e.g. as $50 million excess of $20 million but are in fact "stacked", i.e. once a layer is exhausted any claims not fully recovered from previous layers go straight into the next layer to be recovered up to the limit of the layer, subject to the aggregate available.

Because of the stacking, higher layers of the programme may suddenly be hit by new claims. The chain-ladder method is difficult to use because development is very unstable.

A non-standard method is to model the MIPI programme, incorporating the base limits and deductibles, the per contract limits and deductibles, and the insurer's share of the various contracts.

For the model ground-up losses need to be considered individually; possibly applying individual factors to ultimate, stochastically generating new claims, allowing for win-factors, etc, and then tracking the claims through the MIPI programme model in date of loss order.

The following is one example of the programme for one firm in one year. (Note that many of the programmes are much more complicated.)

Underlying per claim deductibles of $2m for USA, $1m Ex-USA; overall aggregate deductible of $17.m.

Primary Layer: $15m for each of USA and ex-USA; each with one reinstatement (i.e. for each of USA and ex-USA: maximum of $15m for each loss; $30m in total for each of USA and ex-USA).

First Excess Layer: $20m xs $15m each of USA and ex-USA with one combined worldwide reinstatement.

Further excess layers: each with USA and ex-USA cover and one overall reinstatement

$10m xs $35m
$20m xs $45m
$20m xs $65m
$15m xs $85m

with a further layer of $10m xs $100m worldwide with one reinstatement.

As stated above, although each excess layer is expressed as A xs B, the B is irrelevant for calculation purposes as what is covered is what is remaining from the underlying layers. The following chart shows how this works in practice for one particular Firm/Year, with date order shown rather than actual dates for reasons of confidentiality.

Example of MIPI Programme

						15 xs 0		20 xs 15		10 xs 35		20 xs 45		20 xs 65		
	Date order	Gross Claim	Per claim deductible	Net of per claim deductible	Aggregate deductible	Net of aggregate deductible	Primary claims	Primary left	Layer 1 claims	Layer 1 left	Layer 2 claims	Layer 2 left	Layer 3 claims	Layer 3 left	Layer 4 claims	Layer 4 left
USA	1	544	544	0	0	0	0	0	0	0	0	0	0	0	0	0
USA	3	6,784	2,000	4,784	4,784	0	0	0	0	0	0	0	0	0	0	0
USA	4	1,282	1,282	0	0	0	0	0	0	0	0	0	0	0	0	0
USA	7	1,281	1,281	0	0	0	0	0	0	0	0	0	0	0	0	0
USA	10	38,313	2,000	36,313	1,858	34,455	15,000	19,455	19,455	0	0	0	0	0	0	0
USA	11	1,638	1,638	0	0	0	0	0	0	0	0	0	0	0	0	0
USA	12	7,813	2,000	5,813	0	5,813	5,813	0	0	0	0	0	0	0	0	0
USA	13	66,516	2,000	64,516	0	64,516	9,188	55,329	20,000	35,329	10,000	25,329	20,000	5,329	5,329	0
Ex USA	2	1,523	1,000	523	523	0	0	0	0	0	0	0	0	0	0	0
Ex USA	5	586	586	0	0	0	0	0	0	0	0	0	0	0	0	0
Ex USA	6	648	648	0	0	0	0	0	0	0	0	0	0	0	0	0
Ex USA	8	9,119	1,000	8,119	8,119	0	0	0	0	0	0	0	0	0	0	0
Ex USA	9	3,216	1,000	2,216	2,216	0	0	0	0	0	0	0	0	0	0	0
Ex USA	14	25,566	1,000	24,566	0	24,566	15,000	9,566	9,566	0	0	0	0	0	0	0
Ex USA	15	8,744	1,000	7,744	0	7,744	7,744	0	0	0	0	0	0	0	0	0
Ex USA	16	1,282	1,000	282	0	282	282	0	0	0	0	0	0	0	0	0
Total		175,034	20,158	154,875	17,500	137,375	53,026	84,349	49,021	35,329	10,000	25,329	20,000	5,329	5,329	0

8. Swing-Rated Contracts

Swing-rated contracts are typically excess of loss contracts where a deposit premium is paid at the start of the contract and this is adjusted after an initial period, say three years, and annually thereafter based on a formula. The formula might be something like 100/70 times the claims subject to a fixed minimum and maximum value. Complications might include an aggregate deductible and/or limit.

Such contracts are commonly used for medical malpractice working level layers and for motor excess of loss in some countries.

The chain-ladder method may be used both on paid or incurred claims and also on premiums. This can be unstable as there may be a limited number of contracts where the formula maximum is exceeded, or there may be a limited number of years where a substantial number of contracts exceed the maximum.

A non-standard method is to do a contract-by-contract analysis. For each contract, depending on the data available:

- Either work on ground-up losses, possibly stochastically, or on bulk losses to the layer
- Estimate ultimate claims to the layers allowing for per claims deductibles and limits and aggregate deductibles and limits (using development factors, e.g. from overall ground-up experience or benchmarks)
- Calculate the adjustment premium from formula
- The reserve required is then future claims less future premiums.

9. Subsidence

9.1 Background

Cover is provided under the Buildings Section of Domestic Household policies, and under the Property section of Commercial Packages, although this type of claims is much less of a problem in the later case due to the better construction of these properties. In some cases, cover may be arranged under block policies arranged by intermediaries, in which case little information will be available to the insurance company. Apart from in this situation, claims data are readily available and are usually coded separately from other property claims.

Claims are more likely when property owners are moving house as problems will be revealed in the survey. It is hard to establish a date of loss for these claims as the problem is gradual and will only be noticed when a certain level of damage becomes evident. The date of loss affects which policy will be impacted and it is usual to use the date of notification as a proxy, as claims will be quickly reported once noticed. As a result of the problem with the date of loss it is common to have a claims sharing arrangement between insurers. If the insured changes insurance company and there is a claim soon after, the costs will be shared with the previous insurance company according to agreed market guidelines.

Claims are long tailed by comparison with those arising from most other property perils covered. Often, the building will be left for a period of time before any work is attempted, to allow the situation to stabilise. The work involved is often considerable, with loss adjusters, soil laboratories, and engineering companies all having a high degree of input. As a result, the time taken to settle the claims once notified is often longer than for other perils covered. Once notified, a case reserve is usually established, along with any potential for recoveries. Subsidence claims are usually large and are currently running at around an average value of £8,000.

Claims frequency and amounts are influenced by several factors:

a) weather - cold, dry winters followed by hot dry summers cause the worst damage to foundations, both in terms of the number of claims and the severity

b) geographic area - this can influence both the frequency (certain soil types especially clay are more likely to suffer from subsidence, and housing density is higher in the South of the country) and amount of claims (houses in certain areas cost more to repair).

9.2 Premium Reserves

No explicit adjustment is made to the UPR for this business, although seasonality could be a factor, as most claims arise in the latter part of the summer after the ground has fully dried out. Premium is not separately identified as relating to the subsidence cover, but an AURR may be held if overall the class of business looks likely to make a loss.

9.3 Claims Reserves

Separate triangles for numbers and amounts of claims can easily be derived for subsidence and other claims. Outstanding claims reserves are nowadays more likely to be fairly reasonable as due to their size they will be set on a case by case basis. However, for a substantial proportion of claims, the reserves held may prove to be insufficient due to the number of parties involved and problems discovered only when the contractors submit their quote. IBNR claims can be calculated from either development triangles or a delay table, with amounts being obtained from recent claims data. If splits of data by geographic area are available then different incidence rates and claims amounts can be used to reflect both adverse weather conditions and the geographic split of the portfolio. These factors can be applied on a yearly basis to the portfolio.

10. Holiday Insurance

10.1 Background

Cover may be provided by either one off policies or annual cover. Additionally, elements of the risk may be covered under domestic contents policies. These will be looked at separately.

Cover usually includes: medical expenses, personal liability, personal accident, cancellation of the holiday and luggage or goods taken away. Policies are available that exclude this last item as in some cases the cover may be provided under the insured's domestic contents policy. Claims for cancellation, personal accident, or property loss are generally short tail, being quickly reported and settled. Property loss claims are frequent, with claims arising on about 10% of policies, although the amounts claimed are generally small. As proof of loss is difficult some insurers ask for copies of police reports in cases of theft which can cause settlement delays. Personal accident and liability can lead to a few very large claims, although the incidence is low. In the former case these claims may be slow to settle, although in both cases notification is usually quick. Medical expenses can lead to a few very large claims if substantial treatment is needed abroad in a country such as the USA, or if repatriation is needed. However, the majority of the claims are for small amounts. A helpline is often provided, and many hospitals will require proof that the patient is insured before starting major clinical procedures, so notification is quick. For reserving purposes, claims information is often split into medical, liability, and other, assuming that sufficient data are available.

Because of the high volume, small premium size nature of the business, information is often provided only on Bordereaux. Thus, information about individual claims is often lacking and because administration, including claims handling, is often performed by third party administrators, a degree of control over this may be lost.

Much of the cover is in the form of single trip policies purchased when the holiday being covered is bought, or just before the holiday is taken. Often this is purchased thorough a travel agent and substantial commission is paid. As such, the cover, even for policies covering only the one holiday, may be bought up to a year before the holiday is due to be taken. However, if the policies are sold through a third party the holiday may well have been taken and the claim made before the premium has been received. Information is likely to be scarce, except possibly for a split by geographic area.

10.2 Reserving

The main problem in terms of reserving is how to earn the premiums. Typically, they are earned over a four month period and as a result this can give problems matching up the premiums and claims as information is so limited. UPRs are usually set using the four month earning period to allow for the advance purchase. As a counter to this premium receipt is often substantially delayed. Because commission is usually high a large DAC reserve is often set up if premiums are gross. Claims are usually split into medical and other, and both are reserved using simple methods. Outstanding reserves are usually only held for short periods of time, as claims are often notified and settled at the same time. They should be accurate in the case of non-medical claims, but this is not necessarily the case for medical or liability claims as in the former case the condition may worsen as treatment continues and in the latter case it is often very hard to assess the claim. IBNR for all types of claim is likely to be small and so will be set using a simple approach such as a percentage of premium.

Annual policies are becoming more common. These are often purchased directly from an insurance company, just before a holiday is taken, and provide wider coverage in terms of geographic location. Again, information may be limited if this is written through an intermediary. The problems with premium reserving are less pronounced, although it is unclear when the exposure is occurring, so in practice premium may be earned over the whole of the policy term. Systems constraints may limit how these can be dealt with in practice.

11. Medical Expenses

11.1 Background

This cover is usually provided by specialist companies, and is usually written as part of the short term business of a company, although in some cases this may form part of the long term business. It is offered on both an individual and group basis. Cover varies widely between companies with many offering additional benefits. Policies may cover any of the following: in-patient, out-patient, home care, day care, cash benefits. Cover is often for various levels of benefit and may have limits or excesses. Probably the main determinant of claims frequency and amount is whether or not the cover is in-patient only and the age of the policyholder.

Different interpretations may be placed on when a claim is notified, e.g. when a claim form is requested or when a bill is received. Some companies require claims to be pre-authorised which removes the need for an IBNR reserve. The business should be regarded as being short-tailed with claims notified and settled quickly. Some business is written direct to the company although most is in the form of group schemes where data may be more limited. Claim sizes tend to be reasonably small, with very few exceeding £25,000, so little reinsurance is used. The other very important factor that affects claims sizes is how good the claims control procedures of the company are.

11.2 Premium Reserves

These are generally set allowing for the number of days cover that are unexpired, this is usually on a level basis although seasonality is thought to have some impact on the claims frequency DAC is often allowed for.

11.3 Claims Reserves

These may be held as a single reserve, or IBNR may be separated out from notified claims. Sufficient information exists to enable either a chain ladder or statistical method to be used. Both are common in practice. If data are not readily available, or if this is a new class of business, then a simplistic approach seems to work well, such as a percentage of annualised premium or an average written premium per day multiplied by number of days. Adjustments for seasonality and rapidly changing premium volumes may be made if applicable. Large claims reserves are not generally used due to the cover provided and the fact that the insurer is usually invoiced regularly throughout the claim so is generally aware of the likely ultimate cost. Additional reserves such as contingency reserves and reserves to cover older insured policyholders, if they have the right to continue cover after a certain age, may be held, particularly if there is a cross-subsidy in the charging structure between different age groups of policyholders.

If a statistical approach is followed it is usual to model the claims frequency and amounts separately. It is common to use a fixed claims frequency depending on the age and cover offered and then use a Pareto distribution to obtain expected claims amounts. However, it should be noted that the tail on this is higher than would be encountered in practice, so this will tend to overstate the amounts. The other approach would be to use a Compound Poisson distribution to model the total outstanding claims.

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