1998 GISG Reinsurance Pricing Working Party

Members of the working party: Sanjiv Chandaria (Chairman)
Tony Hartington
Matthew Maguire
Grant Maxwell
Bill McConnell
Gregory Overton
Julian Ross
Simon Sheaf
Les Waters
Rosi Winn

Introduction

1 This paper describes the work undertaken by the 1998 Reinsurance Pricing working party and is divided into three parts as follows:-

(a) aims of the working party;

(b) progress to date; and

(c) discussion of the issues affecting the use of actuarial techniques in reinsurance pricing.

2 In effect, the second part listed above is a report on our progress up to the time of writing the paper (late July). Our work has continued since then and an update will be provided in the workshop.

3 The third part of the paper is intended to give a flavour of the practical difficulties faced, particularly those relating to individual risk excess of loss contracts. It is our intention to illustrate as many of these issues as possible at the workshop using numerical examples. The issues are based on our collective views, although not all the views expressed are necessarily shared by all members of the working party.

4 Whilst the paper could be used as a reference guide, we emphasise that it should not be regarded as a substitute for the reader's own technical knowledge and professional judgement.

5 The remainder of this paper is structured as follows:-

Aims of the working party

6 A number of options were discussed in the early stages of our work. We eventually decided to illustrate the practical application of actuarial techniques to reinsurance pricing in the London Market using the data actually available. Following an initial data gathering exercise (described in the Progress to date section), we decided to concentrate on two classes of business for this year's GISG conference, with the hope that the working party would continue and would address other classes for future years' conferences.

7 Our aim was to produce a paper that would demonstrate to the reader some of the practical problems faced. To do this we hoped to:-

(a) create a case study tracing the rating of a risk from the initial submission, through the subsequent data requests and information gathering process, ending with the final quoted price and the decision of the potential reinsured;

(b) base the work on real life examples using data from risks, say, 2 or 3 years old;

(c) use market statistics (in the form of increased limits factors (ILF) curves or first loss tables such as Ludwig tables) where these were available;

(d) where market statistics were not available, attempt to create new market statistics using data from those insurance and reinsurance companies, and Lloyd's syndicates, which were prepared to supply data; and

(e) give an indication of the typical timescales involved throughout the rating process, hence of the potential limitations on what could actually be done in practice.

8 In this way, we hoped to produce a paper which would have practical benefits for the reader.

Progress to date

9 Our aims were quite ambitious and were clearly heavily dependent upon the availability of the necessary data.

10 Our first action was to issue an initial questionnaire to a number of insurance and reinsurance companies, and Lloyd's syndicates, to gauge the possibility of collecting data for our work and to establish the extent to which the data desired might

be available. The questionnaire was generally sent to the organisation's actuary with the request that he/she discuss it with the appropriate underwriters.

11 The response to the initial questionnaire was positive with a number of organisations indicating a willingness to provide data to help in our work. Having considered the classes underwritten by those organisations prepared to participate, we decided to concentrate on property and employers' liability for this year's work. We issued more specific questionnaires (attached in the Appendix) to the willing participants to describe our intended work and to request the following data:-

(a) individual claims data to create market curves;

(b) reinsurance submissions to act as the basis of practical rating examples.

12 Unfortunately, the receipt of data has been slower than we had hoped. We believe the main reasons for this include:-

(a) many organisations are very busy and our data extraction (understandably) is a lower priority than regular business;

(b) the data requested may not be available or the systems might not be capable of readily providing it;

(c) having received a specific request for data, the organisation may have realised that there are confidentiality issues to be addressed. This would particularly be the case for reinsurers where the data requested might belong to their cedants.

13 Since we expect this project to be ongoing we would encourage those organisations that received the second questionnaire and are able to provide the data requested, to send the data as soon as reasonably possible. We would also be pleased to receive data from those organisations who have not been sent the questionnaire, but believe that they would be able to provide the data requested.

14 In the remainder of this paper, we have discussed some of the practical issues involved in rating. It is our aim to use the data available to us to illustrate as many of the issues discussed as possible and to present this work at the workshop.

Issues impacting the use of actuarial reinsurance rating techniques

Introduction

15 In what follows we have only considered the estimation of the expected loss cost to the proposed contract, which we have referred to as determining the *rate* of the contract, or *rating* of the contract.

16 Determining the *technical price* of the contract involves allowing for expenses, profit, investment income, capital allocation, reinsurance, and so on. The *actual price* of a contract would generally be determined by the lead underwriter, taking into account factors which are outside the ambit of the actuarial rating analysis such as business strategy, consideration of the profitability of other contracts with the reinsured, market conditions, payback, and so on. Discussion of the issues surrounding the quantification of the technical and actual prices are all outside the scope of this paper.

Rating techniques

17 There are several basic techniques for rating reinsurance contracts, including:-

(a) experience rating;

(b) frequency severity modelling; and

(c) exposure rating.

18 The basic recipes for these techniques are outlined in the 1995 GISG paper "Pricing in the London Market". We discuss some of the issues that need to be resolved, or at least considered, when applying these techniques in practice, with particular emphasis on (a) and (b) above.

19 The aim of experience rating is to use the actual experience of the cedant to estimate the expected loss cost of the contract being rated. This is often done by ignoring certain features of the contract such as aggregate deductibles and limited reinstatements initially, and then making explicit adjustments for these factors.

20 Ideally, the historical data should be restated to a common level using the following three basic adjustments:-

(a) restate the losses in current day values by adjusting for loss trend (also known as claims inflation);

(b) develop the losses to ultimate - this represents the allowance for IBNR and/or IBNER claims (ie newly reported claims and/or changes in the amounts of currently reported claims, including reopened claims);

(c) restate the historical exposure base in order to make it consistent with the exposure base of the contract being rated.

Format of the remainder of this paper

21 We have attempted to highlight some of the practical issues faced when the above and other adjustments are applied and have suggested potential solutions to some of them. It should be noted that, whilst we have attempted to consider each issue in isolation, many are inextricably linked. No doubt there are other issues that we have not addressed. We hope that some of these other issues will be raised and discussed at the workshop.

22 As the frequency severity approach is often based on the actual experience of the cedant, many of the same issues considered for experience rating will also be relevant for that approach. In addition, we have concentrated on individual risk excess of loss contracts, although many of the issues described are also relevant to other types of reinsurance.

23 We have used the term "claim year" to refer to the definition of year that the contract being rated uses as its period of coverage. For example, a claim year may be the accident year for losses occurring during coverage, the underwriting year for risks attaching during coverage or the claims-made year for claims-made coverage.

Loss trend adjustment

24 We need to adjust the historical claims experience to allow for the impact of claims inflation. To take account of this we have to consider:-

(a) how should trend factors be applied?

(b) what trend factors are appropriate?

(c) how to derive suitable trend factors?

How should trend factors be applied?

25 Claims inflation is a calendar year effect. Ideally, therefore, the trend factor adjustment would be applied to individual claim amounts based on actual settlement dates. In practice the data required for this is frequently not available. The adjustment

for loss trend could, however, be applied to accident or underwriting year data as an approximation if the dates of settlement are not available.

26 If calendar year trend and settlement patterns have remained constant over time then there will be no difference in the results, but if either has changed, then the calendar year trend could be converted into a claim year trend as follows:-

(a) calculate an index value for each calendar year based on the assumed calendar year trend factors;

(b) for each claim year, use an assumed settlement pattern to give the expected settlements in each calendar year;

(c) for each claim year, calculate a weighted average of the index values for each calendar year using the expected settlements as the weights; and

(d) derive the claim year trend factors from the weighted index values in (c).

27 If loss trend is being applied to claims based on the date of settlement to restate all amounts in current values, then one needs to make further allowance for the impact of loss trend in the time until open claims are settled in the future.

28 If loss trend is being applied based on claim year then one has effectively transposed the experience of the year as if it had happened in the period being rated. Therefore, it includes an allowance for future claims inflation at historical levels.

What trend factors are appropriate?

29 The appropriate trend factors will differ depending upon variables such as class, territory, calendar year and size of claim. Depending on the territory and years involved, an additional allowance for social inflation (ie inflation other than price/wage inflation) may be needed.

30 Some cedants set case reserves by allowing for claims inflation between the time a case reserve is established and the expected date of settlement. Others set case reserves that are intended to be the expected value of the claim in current values. The trend factor applied must clearly take account of this.

31 By applying trend factors to claim years which are based on past levels of claims inflation and development factors which implicitly include historical claims inflation levels, we are effectively assuming that the same implicit rates of claims inflation will apply in the future. This may not always be appropriate. In particular,

economic factors may make the rates of claims inflation in the short to medium term significantly different to those applied in the recent past.

How to derive suitable trend factors

32 For classes with large volumes of claims it may be possible to explicitly determine the loss trend implied, using methods such as the analysis of average claim sizes, possibly capping large claims if required. The average claim size from different claim years at the same point of development can be compared to give the trend. Whilst this method is appropriate for ground-up claims, it may not be so for layered claims where each successive claim year will be impacted by claims increasing into the layer and by claims increasing to above the upper limit.

33 Bracket creep inflation has an impact on the data used to derive trend factors. For example, take a submission that contains historical claims data for all claims over £50,000 from 1989 to 1998. At 5% inflation p.a. the 1989 threshold is equivalent to £50,000 * (1.05)^9 = £77,566 in 1998 figures. Therefore, to perform an analysis on a set of claims which is above a threshold consistent in real terms over the period 1990-8, the threshold in each year should be increased by 5% per annum.

34 Even for ground-up claims, bracket creep inflation creates a problem with this approach that arises when looking at claims over a certain threshold. If the threshold is fixed in monetary terms, then as trend pushes claim sizes higher for equivalent claims, smaller claims that would not have exceeded the threshold in earlier years do so in later years. Therefore, the observed trend factors from a simple comparison of average claim sizes for successive claim years will need to be treated with caution.

35 A number of other ways of measuring trend from historical data are discussed within the LIRMA bodily injury claim award study, to which the reader is referred.

36 If there is insufficient data from which to estimate the trend factors (for example, if claim frequencies are small), then the choice of trend factors becomes a matter of judgement. It may be possible to use a suitable index.

Developing losses to ultimate

37 Before current claims information can be used for rating purposes, it must be developed to ultimate.

38 For a standard reserving exercise, we would recognise that individual claims are generally not capable of projection and, instead, create a statistically credible triangle of aggregated claims from which to derive development factors. A simple approach when rating is to apply these same factors to all individual claims as in the 1995 GISG paper “Pricing in the London Market”. However, there are some problems with this approach as discussed below.

Distinguishing IBNER and pure IBNR claims

39 Development triangles allow the estimation of aggregate development factors to calculate the total IBNR which comprises the following:-

(a) changes in case reserves for individual claims as they move to ultimate ('IBNER');

(b) the reopening of individual claims that were closed (also 'IBNER'); and

(c) the appearance of new claims that have been reported late ('pure IBNR'), assuming the triangle is not on a report year basis.

40 Applying a development factor derived from aggregate claims to each individual claim gives rise to the following problems:-

(a) on average, the likely development of the existing individual claims will be overstated by the amount of any pure IBNR allocated in excess of the IBNER required;

(b) the total number of claims will be understated by excluding pure IBNR claims;

(c) any individual claims will develop very differently from the average.

41 These problems may have a significant impact on the rates derived for an excess layer using the experience rating approach and the parameters chosen for a frequency severity approach.

42 We consider the following to be reasonably practical solutions to the problem of estimating "more accurate" total IBNR and IBNER figures. They are clearly very dependent on the availability of the necessary data.

(a) The first possible solution involves:-

(i) projecting numbers of claims to estimate the number of pure IBNR claims. A separate severity amount can be applied to each of these IBNR claims (perhaps derived by an analysis of severity trends in claims by reporting delay) to make an estimate of the pure IBNR. Subtracting this estimated pure IBNR amount from the total IBNR projected from the triangle gives the IBNER component;

(ii) allocating this IBNER down to known claims using an appropriate method which might encompass such aspects as paid claims, outstanding claims, speed of development and reporting delay to decide how much of the IBNER each claim deserves. In this way, we are using as much information as possible to develop individual claims by appropriate factors.

(b) A second possible solution recognises the likelihood that claims reported at different times will develop in different ways and deals with the groups of claims accordingly:-

(i) produce separate triangles based on claims with the same reporting delay. Development factors for each of these can be calculated and used to project the claims consistent with each triangle. Subtracting the IBNER so calculated from the total IBNR to give the pure IBNR.

(ii) A projection of claim numbers must then be used and combined with a severity distribution and the total amount of pure IBNR to give the number and amounts of individual pure IBNR claims

(c) A third solution involves estimating a distribution for the average loss development factor for the overall IBNER, and simulating values to apply to individual claims. The pure IBNR has to be estimated using one of the other methods.

43 These solutions, however, require more information than may be available from a typical reinsurance submission.

Derivation of Loss Development Factors (LDFs)

44 In order to derive LDFs a chain-ladder type methodology based on triangulated data is generally used. Ideally the paid and incurred development of each claim which could impact on the layer to be rated would be provided.

45 In practice, this level of data is rarely available. Instead, if triangulated loss development data is provided at all, it may be in one of the following formats:-

(a) Development of the ground-up experience of the classes to be covered by the contract. The problem with this data is that the LDFs derived from this data may not be appropriate to the larger claims that will impact an excess of loss contract.

(b) Development of those claims above a fixed truncation point.

(i) Although this is possibly more appropriate than data in the format of (a), there is the problem that the use of a fixed truncation point for all previous years will be equivalent to a decreasing truncation point over time in real terms (ie bracket creep inflation has an impact). The data is, therefore, not homogeneous;

(ii) It is possible that data may be in respect of those claims which are above the truncation point at the "as at" date of the data, rather than those claims which are above the truncation point at some point in their development. Data in the first form is easier to extract, as one only needs to check the claim size against the truncation point once. It does not, however, include those claims that were above the truncation point at some point and have now developed to lower than this point. Any LDFs derived from this data are, therefore, likely to overstate the expected future development;

(iii) In both (i) and (ii) above, the data provided might either be the ground-up claim amounts or the amounts in excess of a truncation point, especially if this is the proposed deductible**.**

46 We need to make sure that we are applying LDFs that are appropriate to the rating method being employed. A variety of methods are available including basic chain ladder and inflation adjusted chain ladder. These can be applied to claim number and claim amount triangles to identify the IBNER and pure IBNR components as discussed above.

47 The LDFs used need to be consistent with the method used to trend the losses. Consideration should be given to whether future inflation has been adjusted for within the trending or needs to be allowed for within the development to ultimate.

48 We also need to consider whether the claims are open or closed. A portion of the IBNER relates to the reopening of closed claims. A theoretical method of estimating this portion of the IBNER involves projecting the numbers and amounts triangles for reopened claims and subjectively allocating to those closed claims that are considered most likely to reopen. This is unlikely to be achievable in practice and, therefore, the overall IBNER component is likely to be applied simply to the open claims. Clearly, this overstates the true IBNER on open claims and understates the reopened portion of the IBNER on closed claims.

Layer then develop (LD) or develop then layer (DL)?

49 This issue relates to whether individual claims data that has been trended should be layered and then developed to ultimate or developed then layered. By layered, we mean that we have calculated the amount of each claim in each excess layer being considered.

50 In making this decision, we should consider our overall aim in experience rating ie to use the historical data to estimate the losses to be expected for the contract being rated. Clearly, an important consideration in the choice of LD or DL is the data available:-

(a) development data for individual claims allows development factors for losses in the layer or for ground-up losses to be calculated. This enables both LD and DL to be performed and it is certainly beneficial to do both;

(b) development data just for aggregate claims only allows aggregate development factors to be derived and the same factors are likely to be applied to the current amounts of all individual claims in a claim year.

51 In the case of LD, triangles of layered losses are required to ensure that the development factors used are appropriate to the layer. If this data is not available, then development factors based on aggregate claims must be used and will ideally need to be adjusted for the following:-

(a) claims that develop into the layer;

(b) claims that develop to exceed the upper limit of the layer; and

(c) claims within the layer that develop to below the lower limit of the layer.

52 In practice, making these types of adjustments is difficult and judgement will be required.

53 In the case of DL, if only aggregate development factors are available, then it may not be possible to allow for the variation in individual claims development. If, however, development data for individual claims is available then we may allow more accurately for the ultimate position of each individual claim and allocate these to layers appropriately.

Exposure measures

54 In order to rate a contract it is necessary to relate the restated claims experience to an appropriate measure of the exposures under the contract. The following must be considered:-

Choice of exposure measure

55 A good measure of exposure is one which is able to quantify the risks underlying the contract, is readily available and is objective. The choice of exposure measure used may be restricted by the information provided by the cedant. For example, when rating motor business the number of earned vehicle years may be considered the most suitable measure, however, the cedant may provide details of the original premium for the underlying policies instead.

56 Further, the situation may arise where the cedant provides fewer years of exposure information than of claims details. This means it would be necessary to make assumptions as to past changes in exposures under the policies in order to make full use of the claims information.

Restating exposure measures

57 The chosen exposure measure may need to be restated to be on a basis consistent with the trended claims. Adjustments may need to be made for inflation and rate level changes (including past rate inadequacies). An example of this would be for employer's liability cover where payroll is often used as a measure of exposure. Even if the risks being covered had remained unchanged the payroll would increase through wage inflation. It would be necessary to inflate past years exposure data to current levels. This could be done using publicly available statistics such as the National Average Earnings index or by using industry or company specific information.

Use of subject premium as the exposure measure

58 In this case past changes in primary rate levels and coverage need to be considered. The subject premium is being used as a measure of the actual underlying risks so the data needs to be adjusted to reflect current primary rate levels. Ideally the cedant would provide details of rate level changes although these may not be available in a form that is readily usable. An alternative is to use rate level indices provided by market bodies or to use underwriters market knowledge to establish broad rate level changes.

59 If the primary policy terms have changed, eg excess levels, the subject premium would differ from that required for the current terms and would therefore require adjustment.

Use of ceded premium as the exposure measure

60 Ceded premiums are often provided rather than subject premiums. The considerations required are a further complication of the case using subject premium. Past reinsurance rates are unlikely to be known for the whole period thus assumptions are required for changes in reinsurance rate levels. These are unlikely to be the same as the primary rate level changes.

Relevant exposures

61 Not all of the primary policies being covered may expose the layer being written because of, for example, policy limits. Care is therefore needed to ensure that only the exposure measures from the relevant policies are included, although these may be difficult to identify. The comments under the sub-section *"Underlying policy limits"* about ECO and XPL should also be considered.

Multiple types of cover

62 Contracts providing more general or complicated types of cover may require a different treatment. For example, a general commercial policy may cover a number of types of risk eg products liability, commercial fire, business interruption, employers' liability etc. where the ideal exposure measures for each type of risk differ. A standard solution to this would be to select a single exposure measure for the predominant type of claim or one that is a good proxy for all the types of risk.

63 If sufficient information is available a more detailed approach may be taken using different measures for different types of claim e.g. payroll for employers' liability and turnover for products liability. Alternatively it would be possible to use a mixture of different measures, however trends in the balance of risks or changes in the levels of cover offered may cause problems with this solution.

Claims made policies

64 Claims made policies present problems because at any stage policies remain exposed to claims from some or all past years that are not covered by occurrence policies and so need to be allowed for in the exposure measure. This could be done in a similar manner to the conversion of calendar year trend factors to claim year trend factors, but using reporting patterns in place of settlement patterns and exposures in place of trends.

Frequency severity distribution modelling

65 The 1997 paper "Aspects of Pricing in the London Market" presented to the Institute of Actuaries, advocated the method of combining frequency and severity

distributions for the rating of reinsurance. This involves the selection of a distribution for each of the frequency and severity of claims and then of a method for combining these.

66 Whether looking at the severity or frequency component, the decision must be made as to whether or not a theoretical distribution needs to be applied. With the advent of more powerful computing resources and where the underlying data is extensive, a sampling approach may be preferable to fitting a theoretical distribution.

67 Nevertheless, theoretical fitted distributions do have some distinct advantages such as:-

(a) in reinsurance there is rarely sufficient data to rely on an empirical distribution;

(b) theoretical distributions allow for the implementation of judgement to smooth out any random fluctuations;

(c) when rating layers that extend beyond the largest current claim, it is important to have some indication of where claim sizes are going. While extrapolating a curve is highly subjective, it does at least provide a starting point;

(d) theoretical distributions are summarised by a small number of parameters, allowing easy comparison with benchmarks, such as past years or market results.

Selecting the frequency and severity distributions

68 If a theoretical distribution is to be fitted, there are two main approaches for determining a likely model:-

(a) using the shape of the density or cumulative distribution functions, which often provide an idea of the underlying distribution;

(b) using the shape of the mean residual life function.

69 Comparisons between the observed curve and various theoretical distributions can be made by either the “Class 1 Eyeball Test” or a number of statistically based goodness of fit tests including Pearson’s chi-square, maximum likelihood, Kolmogorov-Smirnov and a comparison of moments.

70 For both approaches, as with other areas of actuarial work, it is imperative that basic exploratory data analysis is carried out, and that simple reliance is not placed on

a “black box” package. Only through this analysis will the rating actuary understand the data.

71 When fitting theoretical distributions it is important that the claims are as homogeneous as possible. However, care must be taken to ensure that claims are not split into too many groups as:-

(a) each group requires the fitting of a curve resulting in more parameters to estimate;

(b) correlations between each pair of groups may need to be determined meaning even more parameters are required;

(c) credibility of data in some groups may fall to the level where fitting is no longer feasible.

Producing the aggregate loss distribution

72 Once the frequency and severity distributions have been chosen, they need to be combined in some manner. There are a number of methods of obtaining this compound distribution:-

(a) numeric calculation of the distribution function (eg Panjer’s algorithm, Heckman-Meyers algorithm);

(b) simulate the distribution (eg spreadsheet add-ons, statistical software);

(c) additionally, in some cases, it is possible to approximate the distribution according to established mathematical relationships (eg normal, normal power, shifted gamma), although this method does not work well for low frequencies.

Examining the results

73 Any mathematical model involves a simplification of the real world. Whilst the result of the compounding is a distribution of the aggregate cost of claims, it is important to remember that this is not the only variation involved. It should be noted that the 95th percentile of the resulting distribution is not necessarily the point that will be exceeded 5% of the time in reality. This is because the percentile relates only to stochastic error, ie the residual variability around the forecast.

74 In addition to stochastic error, there are other potentially larger sources of error to consider:-

(a) selection error - an incorrect independent variable upon which the model is based;

(b) specification (model) error - eg use of a Pareto curve instead of a lognormal;

(c) estimation (parameter) error - due to the fact that the parameters selected are based on a random sampling of possible claims.

75 One final point that needs to be considered when fitting distributions is the same thing that plagues most actuarial analysis; even if a good fit is achieved there is no guarantee the model is valid for predicting the future.

Other claims features

76 Other claims-related features that can have an impact upon trend, development factors and exposure are discussed below.

Large and/or catastrophe claims

77 The historical claims experience is likely to be distorted by the inclusion of large claims in the data. Such claims will only affect certain years or cohorts which may then develop differently from the other years or cohorts. This makes it difficult to project the ultimate claims and, hence, rate the new contract.

78 A more reliable projection is likely to be possible if all claims are capped at some fixed level. The cost of claims above the cap could then be estimated and spread across an appropriate number of years and cohorts by way of a loading.

79 When curve fitting, the number of claims towards the upper end of the claim size distribution is likely to be low with the result that the available data lacks credibility. This could lead to errors in fitting the tail of the distribution. For example, if there were an unusually low number of such claims in the historical experience then the fitted tail would be too thin.

80 In a rating exercise the causes of any large claims in the historical experience should be considered in order to determine whether there are any factors that would prevent the occurrence of the same or similar claims in the future. Examples of these factors might include exclusions that have been added to the policy wording or changes in policy conditions. In these situations, consideration should be given to removing the cost of such claims from the rate that is being calculated and equivalent exposure adjustments may also be needed.

81 A more difficult problem is the converse situation – where policy conditions have changed in such a way that there is a potential for large or catastrophic claims which were not covered in the past to affect the treaty in the future. An example of such a situation may include the removal of an exclusion clause. Clearly, the historical data in isolation would be of little help in estimating the cost of such claims.

82 One possible approach would be to use the historical data to determine the cost for all claims other than these potential "new" large losses, and then use exposure methods for the potential "new" large losses.

Generic claims

83 A similar issue to the above is caused by the existence of certain types of claims which are neither large nor can be aggregated for reinsurance purposes. Past examples of such claim types include Lloyd's agents' E&O, pensions mis-selling and mortgage indemnity. There are two main options to such claim types:-

(a) remove from the historical data and apply a loading at the end of the rating process;

(b) leave the historical data unchanged so that an implicit allowance for similar (not the same) claim types to emerge in the future is retained.

Underlying policy limits

84 Claims on the underlying policies, which are the subject of the reinsurances, will generally be capped at those policies' limits. When using the underlying claim data to rate an excess layer it is important not to project claims above the underlying policy limits. An exception relates to expenses that may be in addition to policy limits.

85 It should be borne in mind that policy limits and exclusions have been overturned in the past by US courts in certain situations. For example, some courts have imposed Excess Policy Limits (XPL) or Extra Contractual Obligations (ECO).

86 Policy limits may also be one factor causing clustering of claims at certain sizes (other factors may be the reserving policy of the cedant). In such situations, the empirical severity distribution will have discontinuities and care is required when fitting severity distributions to such data.

87 If the policy limit is known for each individual claim, then curve fitting techniques can allow for the impact of policy limits (see "Estimating casualty insurance loss amount distributions" by Gary Patrick – PCAS1985).

Line size

88 The claims experience provided may be distorted by changes in line size over time. For example, consider a property account where the cedant has written shares of individual risks where the shares vary from risk to risk. Unless the balance of the account remains the same from year to year, past years' loss experience will present problems if used for rating the new contract.

89 Any curve fitted to the historical claim data from the cedant will not represent the true distribution of the actual 100% claim amounts. Using such a curve to price future contracts may give a reasonable answer if the cedant continues to write the same shares of similar risks. If the profile changes, the curve will become inappropriate. If the data can be adjusted to a 100% level, this problem may be resolved. Similarly, where a curve is derived from a number of cedants whose profile of shares of individual risks vary, it may not be appropriate for any given cedant.

Loss sensitive contract terms

90 This section covers special clauses in the contract structure that respond to the losses. Examples include profit commissions, swing rates, sliding scale commissions (or slides), loss corridors, reinstatement premiums and aggregate deductibles. These terms are defined in the glossary.

91 These terms cannot be adequately modelled by looking at the mean of the distributions. Consider the following simple example:-

(a) Profit commission (PC) of 40% after 20% reinsurer's expenses;

(b) The loss ratio is either 200% or 50% with equal probability. Hence the expected loss ratio is 125%;

(c) The PC at the expected loss ratio of 125% is clearly zero.

(d) The expected PC is 0.5 * 40%*(100%-50%-20%) + 0.5 * 0 = 6%.

92 It is clear that the expected PC does not equal the PC at the expected loss ratio. The issue would be further complicated if a deficit carry forward clause were included.

93 A method, which is able to deal with these terms explicitly, is to model the distribution of aggregate losses to the treaty, and use this to price the terms being considered. However, this is often far from simple.

Changes over time

94 Like many actuarial exercises, reinsurance rating typically attempts to extrapolate from the past to predict the future. This may be fine as long as the future develops in line with the past. There are a variety of reasons why this may not be the case, for example, there may be changes in settlement procedures, legal or economic conditions, policy conditions, excesses, coverage provided and self-insured retentions.

95 Before allowance for changes can be made, it is first necessary to identify that a change has taken place. This may not always be obvious from the information presented.

96 Some changes may be temporary and well known, such as the Year 2000 problem, where the solution may lie outside the pricing process. A problem such as this may be dealt with by the use of an exclusion clause, encouraging good risk management or selective underwriting.

97 Legal, economic and attitude changes could include court decisions such as the Ogden judgement, changes in the inflation rate or a hardening of opinions towards pollution. Medical advancements can also have an effect on the expected claim rates for many types of policy. In some cases the appropriate parameters in the calculations can be adjusted but in others a more subjective approach is the only solution.

Appendix

Data specification for UK Employer's Liability

The following data request represents the ideal. Please provide data in this format as far as possible, indicating where only more limited data or an alternative has been provided.

1 Is the data in respect of direct liabilities, inwards reinsurance liabilities or outwards reinsurance covers?

2 The following information for individual claims for as many years as are readily available:-

(a) unique claim number;

(b) territory;

(c) recorded characteristics of insured (including keys to each data field). For example:-

(i) type of industry (eg retail, service, manufacturing and so on);

(ii) occupation (eg by ABI code).

(d) date loss occurred;

(e) date loss notified;

(f) type of claim (eg disease/disability/death);

(g) for coinsurance business, percentage of risk written;

(h) for coinsurance business, claim name (to avoid double counting);

(i) for reinsurance business, cedant name (to avoid double counting);

(j) for reinsurance business, claim name (to avoid double counting);

(k) for incurred claims which have ever been at least £10,000, dates and ground-up amounts of all

(i) indemnity and expense payments (separately if possible) made to date, split by type of claim;

(ii) indemnity and expense outstandings (separately if possible), split by type of claim;

(l) for incurred claims which have never been at least £10,000, aggregated ground-up amounts of all

(i) indemnity and expense payments (separately if possible) by year, split by type of claim;

(ii) indemnity and expense outstandings (separately if possible) by year, split by type of claim;

(m) threshold below which claims are not reported in the data provided (which may vary by year).

3 Paid and incurred claims triangulations consistent with the above information on individual claims, both for the whole account and for various subsets of claims.

4 For the same period as covered by the data, as many of the following measures of exposure as possible (by territory, type of industry, occupation and direct/coinsurance/reinsurance, if possible):-

(a) premiums;

(b) wageroll;

(c) numbers of employees.

5 Significant changes in the following over the same period as covered by the data:-

(a) claims settlement and case estimation procedures/philosophy;

(b) legal/economic environment;

(c) policy conditions;

(d) coverage provided;

(e) self-insured retentions.

Data specification for first loss Property curves

The following data request represents the ideal. Please provide data in this format as far as possible, indicating where only more limited data or an alternative has been provided.

1 Are you able to provide ground-up claims data gross of all reinsurance (including facultative) and sums insured/PMLs on a basis consistent with this?

If the answer is YES, please read the remainder of the questionnaire. If the answer is NO, thank you for your time; unfortunately, we will not be able to use the data that you may be able to provide so please ignore the remainder of this questionnaire.

2 Is the data in respect of direct liabilities, inwards reinsurance liabilities or outwards reinsurance covers?

3 The following information for individual claims for as many years as are readily available:-

(a) unique claim number;

(b) territory;

(c) residential or commercial policy;

(d) recorded characteristics of insured property (including keys to each data field). For example:-

(i) residential: detached/semi-detached/terraced, age, type of construction (eg brick/wood etc), postcode and other relevant features;

(ii) commercial: industry (retail/service/manufacturing and so on), type of construction, postcode and other relevant features.

(e) date loss occurred;

(f) date loss notified;

(g) coverage (eg buildings, contents, business interruption and so on);

(h) peril causing loss (eg fire, wind, catastrophe and so on);

(i) for coinsurance business, percentage of risk written;

(j) for coinsurance business, claim name (to avoid double counting);

(k) for reinsurance business, percentage of risk written;

(l) for reinsurance business, cedant name (to avoid double counting);

(m) for reinsurance business, claim name (to avoid double counting);

(n) sum insured or PML by coverage (buildings, contents, business interruption);

(o) dates and amounts of all ground up indemnity and expense payments (separately if possible) made to date, split by coverage;

(p) dates and amounts of all ground up indemnity and expense outstandings (separately if possible), split by coverage; and,

(q) threshold below which claims are not reported in the data provided (which may vary by year).

4 Definition of basis for PML.

5 Paid and incurred claims triangulations consistent with the above information on individual claims, both for the whole account and for various subsets of claims.

6 Significant changes in claims settlement and case estimation procedures/philosophy, and policy terms/conditions over the same period as covered by the data.

Profit commission (PC)

1 A percentage of the profit on the contract (defined as premium less losses less an allowance for reinsurers expenses) is returned to the cedant. This is common on proportional treaties. It is becoming more common on other treaty types, notably catastrophe excess of loss. There will often be a deficit carry forward for, say, 3 years, so that no PC is paid following a loss year until the treaty over the period returns to profit.

Example

2 A treaty has a PC of 20% after 17.5% reinsurers expenses. In year 1 the loss ratio is 100%, and in year 2 the loss ratio is 0%. The premium is the same for both years at 100.

3 The profit in year 1 = premium – loss – expenses = 100 – 100 – 17.5 = - 17.5, so no PC is payable.

4 The profit in year 2 = premium – loss – expenses + deficit = 100 – 0 – 17.5 – 17.5 = 65.

5 Hence a PC is payable of 20% of 65 = 13.

Sliding scale commission (slide)

6 The commission paid on the contract varies with the loss ratio. This is common on proportional treaties. It operates in a very similar way to a combination of a PC and a flat commission.

Example

7 Commission is 30% at loss ratios exceeding 60%, sliding to 35% at a loss ratio of 50% and sliding to 40% at loss ratios less than 35%. Provisional commission of 30% is paid initially and is adjusted as the actual loss experience emerges.

Swing rating

8 The rate paid on the contract is a function of the loss cost, with an upper and lower bound. Typically used on low layer per risk contracts, where a high frequency of loss is expected. A form of retrospective experience rate.

Example

9 Subject premium is £1m.

10 The contract rate is (100/80)*losses incurred, subject to a minimum of 5% and a maximum of 10% where 80% is the target loss ratio.

11 If losses to the contract are £48,000 then the reinsurance premium is calculated to be (100/80)*£48,000 = £60,000 or 6% of the subject premium.

12 If losses to the contract are £96,000 then the reinsurance premium is initially calculated to be (100/80)*£96,000 = £120,000 or 12% of the subject premium. The limits on the contract restrict this to 10%, ie. £100,000.

Loss corridor

13 On a proportional treaty, the cedant retains losses, or a proportion of losses, between an upper and lower loss ratio. This is a form of loss sharing, and is common where a treaty has had a poor run of experience, or the cedant and reinsurer disagree as to the likely result for the treaty period.

Example

14 Loss corridor is 75% of losses between a loss ratio of 90% and a loss ratio of 100%.

Reinstatement premium (RP)

15 The cedant pays a reinstatement premium in the event of a claim. Common in catastrophe excess and risk excess reinsurance. The payment is usually proportional as to amount not as to time ie if half the layer is blown; the RP is 50% of the maximum value, regardless of when the loss occurs.

Example

16 A catastrophe excess treaty is 1@100 (ie there is one full reinstatement at 100% of the initial premium). This means the treaty can pay up to two times the layer in the treaty period. In the event of a total loss, the RP equals the initial premium.

Aggregate deductible

17 The cedant retains the first loss or the aggregate amount of losses that would otherwise be subject to the cover. Common in low layer risk or catastrophe excess.

Example

18 A catastrophe excess treaty covers losses to the layer £10m excess of £10m. It has an aggregate deductible of £10m and no reinstatement provisions. This means that the reinsurer does not pay the first £10m of losses to the layer, but then pays the next £10m. This layer would usually be known as £10m xs £10m xs £10m (the order being limit, excess, aggregate deductible).

19 Suppose the losses in the layer are £15m, £12m and £25m. The losses to the layer £10m excess of £10m are therefore £5m, £2m and £10m respectively totalling to £17m. Hence, the reinsurer would pay the cedant a total of £7m.