Section D
DIMENSIONS OF CHOICE

Preamble

When embarking on the claims reserving exercise, a number of underlying choices have to be made. Often, they will be constrained by the availability of data, but on other occasions there will be considerable freedom. Again, the choices may not all be made consciously — they may be implicitly made through an office's established procedures for claims reserving. In this case, a periodic review of their appropriateness should still be made.

To make the choices clear, they are here brought out as a series of "either/or" dimensions. But often the right answer will not be "either/or" but "both". The reserver is likely to build up a fuller and more reliable picture if he or she approaches the problem in a number of different ways.

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[D1]
CASE RESERVES v STATISTICAL METHODS

The distinctions made in this subsection, and throughout the whole of §D should be taken as practical pointers, *not* as hard and fast theoretical rules.

Case Reserves

Case estimation is, of course, the province of the claims office. An expert estimator will look at each individual claim, and make an assessment of its value, updating this as time goes by and new information comes in. On the other hand, statistical methods look at grouped data on sets of claims, and make the estimate by numerical manipulation.

This suggests that case reserves will be more apt for large claims and claims which have been open for a longer time.

Characteristics to look for: claims fewer in number but larger and more variable in size.

Statistical Methods

The corollary is that statistical methods will be more apt for smaller claims and for those very recently opened.

Characteristics to look for: claims larger in number but smaller and less variable in size.

Other Notes

By definition, IBNR claims *cannot* be case estimated. Hence it will always be necessary to use a statistical method.

Case estimates *can* be used as an input to a statistical method. Thus, the direct insurer's case reserves on ceded business will become part of the reinsurer's statistical input. And any set of case reserves can be adjusted for bias by a statistical method, given sufficient knowledge of previous years' run-offs.

[D2]
SIMPLE STATISTICAL METHODS v MATHEMATICAL MODELLING & STOCHASTIC TECHNIQUES

When statistical methods are used, there is a wide range of possibilities. The Manual is largely concerned with exploring this range. One choice, made early on and sometimes without realising it, is in the degree of sophistication applied. But two divisions can readily be discerned:

Simple Statistical Methods

Data are charted numerically, and if necessary adjusted manually. Projection is done by intuitive methods, i.e. extrapolating by eye, or using simple averages and trendlines. Algebraic formulae, if used at all, are only for these averages and trends. Although a knowledge of mathematical statistics is not essential, the reserver should be trained to have an understanding of why different simple methods give different answers and what can be learned from them. The aim of this Manual is to provide that understanding.

Methods are "statistical" in the sense that they deal with numerical data, and treat claim sets en bloc (not as individual claims, by contrast with case reserving).

Claims reserving is frequently done in practice this way — in fact, more often than not. An important point is that claims reserves are often needed very quickly for accounts and reports — time is of the essence, and so sophistication may be quite out of place. The commercial imperative has to be obeyed, in preference to the academic ideal.

A final point is that simple methods lend themselves to making quick, commonsense adjustments for various biasing effects in the data — e.g. caused by a known change in the business mix, or the rate of claim settlement, say. Essentially, volume 1 of the Manual is devoted to methods which fall into this category.

Mathematical Modelling & Stochastic Techniques

The basic objection to the simple methods is that they pay no regard to the theoretical foundations. Close examination will show that even apparently intuitive projections have some underlying model on which they are founded. Hence, more can be known about the method, and its strengths and weaknesses, if this model is made *explicit.* (The chain ladder method, for example, has been particularly subjected to such criticism.)

In addition, an explicit model will show much about the conditions in which a particular method is valid, and where it will break down. The conditions for validity may sometimes be wider than previously suspected — e.g. the chain ladder works perfectly well *without* adjustment in conditions of constant inflation.

A further point is that the simple methods will invariably rely on first moments, i.e. the means of statistical distributions. There is no way of tackling the second and further moments — variance, kurtosis, etc. But the variance is especially important in measuring the confidence limits surrounding a given estimate. These are ascertained by explicit use of statistical techniques.

Here, "statistical" denotes the science and methodology of statistics, as taught for example in a degree course or the actuarial syllabus. This meaning goes far beyond the intuitive statistics of the simple methods.

The main disadvantage of the more elaborate methods is that they take more time to pursue. Hence they may prove to be impractical where an estimate is needed very quickly for business purposes. However some sophisticated methods may now be applied quite quickly by using modern computer facilities. Also, the reserver must be more highly trained, and have specific statistical or actuarial knowledge in addition to the insurance background. A trap to avoid is clearly that of indulging in mathematical sophistication for its own sake, without regard to the business needs.

The essentially mathematical and stochastic methods are treated in Volume 2 of the Manual.

[D3]
ALL CLAIMS TOGETHER v SEPARATION OF LARGE AND/OR SMALL CLAIMS

Large Claims

Most reserving work is at present done without much regard for the claim size distribution. The only features of the distribution that regularly appear are the overall frequency of claims and the mean value.

The position is acceptable, provided the claim distribution is comparatively stable. But this assumption will be disturbed if, in a given year, one or more claims of exceptional size are encountered. (The effect will be different, according to whether the data are gross or net of reinsurance for excess of loss. The net data will be less affected, but will still show more claims at the upper limit, i.e. the retention level.)

The simple solution is to remove all claims exceeding a defined high limit, and treat them separately from the main group. This done, it will be natural to use case reserves, or adjusted case reserves, for the larger claims. Then the main group will be dealt with by some statistical method.

The principle can be taken further, if desired. Thus, claims can be stratified into a number of groups by size, and each group projected separately. Alternatively, a theoretical model with an explicit claim size distribution can be employed. Reid's method (see volume 2) is a good example of this line of approach.

Small Claims

Claims for comparatively trivial amounts, and recent claims where little case information is yet available, can be dealt with by using a standard cost approach. (A good example of this is the so-called "Fast Track" system, used in the USA.) The idea is that small, quickly settled claims can be allowed in effect to by-pass the main claim files and reserving records. They are valued by using an appropriate average cost per claim, a procedure that can result in useful savings of administrative effort.

[D4]
FIGURES GROSS v NET OF REINSURANCE/CLAIMS EXPENSE/ SALVAGE & SUBROGATION

Reinsurance

One factor in the choice will be the comparative amount of reinsurance involved. For a large direct-writing company, the amount of reinsurance is likely to be relatively small. Hence it will be reasonable to use the gross figures, and make separate estimates for reinsurance recoveries. But for a smaller company, the proportion of ceded business to the total is likely to be much greater. The effect on reserve calculations will be very significant, and perhaps make net data the more realistic choice, in which case the consistency of the reinsurance programme will be a factor to be borne in mind

Another factor is the type of reinsurance. For proportional business, it would be usual to take the gross data. Reserves for the ceded losses can in this case easily be calculated from the gross figures.

For excess of loss business, the picture is more complicated. The advantage of gross data is that they are not subject to changes in the retention levels. But the projection, once made, must be converted to the net figure for use in financial statements. This might be done, for example, by taking as a credit on the reported claims:

$$\sum (kE - R\text{lim})$$

where summation is for all case estimates kE in excess of the retention limit Rlim. For IBNR, however, the position is more problematical, because historical data tend to be distorted by changes in the retention limits. One solution would be to set up an assumed distribution of the IBNR by claim size, and apply the retention limits accordingly.

If net data are used for excess of loss business, adjustment for changes in the retention limits must be made. One method would be to restate the losses in earlier years as if the current value of the limits applied then. It may be necessary to make allowance for the effect of inflation on the claims sizes and on the retention levels.

Claims Expense

Claims expense can be divided into 2 main categories: direct and indirect. Direct expense means such items as legal and loss adjustment expense which can be attributed to particular claims. Indirect expense covers the general overheads, e.g. in running the claims office as a whole, where it is unlikely that any direct attribution would be made.

The indirect expense, by its very nature, must be assessed by a separate route from the losses on the actual claims. But direct expense can very well be included as part of the loss figures, which is the usual position in the UK. However, in the USA, the losses are often assessed *net* of the direct expense, with separate estimations for the latter.

There is a good reason for the American practice, which relates to the legal system. Practices such as contingent fees, jury awards and punitive damages have led to the escalation of the legal expense element. In some cases, it becomes a very substantial part of the overall cost of the claim (perhaps 30% or even more). The significance for reserving is that the legal expense tends to increase more rapidly with development time than does the pure loss itself. Hence, unless such expenses are separated out, there will be a distortion to the projection, leading to the underestimation of the final overall liability.

It seems that in recent years some of the features of the American experience are beginning to be reflected in UK court decisions. Certainly there is a greater willingness to litigate, and legal expenses are increasing significantly. Hence it is likely that more attention will need to be paid to the separate examination of direct claims expense in the UK in the future.

Salvage & Subrogation

The more common practice is to develop reserving figures gross of salvage and subrogation. Then any justifiable allowances, based on evidence from the claims office, can be made subsequently. A fairly conservative view is likely to be taken of any supposed future recoveries in this direction.

[D5]
ACCIDENT (OR UNDERWRITING) YEAR v REPORT YEAR COHORTS

Estimates can in fact be made without dividing claims into cohorts dependent on a time definition. E.g. assign all claims in a given class a standard value for reserving purposes. The value could be based on a distribution of claim size derived from past results.

But the recommended practice is undoubtedly to divide claims into cohorts with some given time-base. (Data should certainly be available in this form, because of the need to analyse data into cohorts for the returns to the supervisory authority.) The time-base is most usually the accident year, or report year of the claims. But on occasion underwriting year may be used (e.g. in the London Market), or even the settlement year.

Another variation is to use other periods than annual, perhaps half-yearly or quarterly. Even monthly periods can be used, if the data volume is sufficient, or the business type appropriate, e.g. storm damage to houses.

Accident Year Classification

Advantage All claims stem from the same exposure year, and so reflect the experience of that particular period. Variations can be related to the influences operating at that time, e.g. an uplift in business volume or a change in legislation. Adjusting the estimates for inflation will be straightforward.

For accounting purposes, the losses emerging can be compared with the actual charges made to the operations of that period (i.e. the accident year). Also, the classification is consistent with the requirements of returns to the supervisory authority.

Disadvantage The full number of claims in the cohort is not known. It will increase until all the IBNR claims are reported. Hence there is greater uncertainty in using average claim values, for example.

Report Year Classification

Advantage The number of claims is known from the outset. There is a fixed group of claims to be tracked during the run-off, so that statistical estimates have a more reliable base.

Disadvantage The claims in the cohort will have arisen from a number of different exposure periods, and the mix of ages may vary as report years progress, making comparisons less stable. Again, claim patterns can be affected by changes in the definition of report date in the office's data system. Finally, no exposure or premium base exists to underpin the loss development of the cohort.

Underwriting Year

Advantage Claims can be followed which arise from a particular rating series and the results used to test the adequacy of the premiums. Also the classification is often necessary for reinsurers, for whom claims are likely to be specifically related to the business written during a given contract year.

Disadvantage Data take longer to develop, because of the extended exposure period. IBNR emergence continues to disturb the number of claims in the cohort until the ultimate development is reached. Correction for inflation becomes more complex than with the accident year cohort.

Settlement Year

Advantage Can be used for short-tail lines, where claims are incurred, reported and settled within a short time interval.

Disadvantage Of little use for medium and long-tail lines. Claims in the cohort are too heterogeneous by their occurrence dates.

Report Year within Accident Year

Advantage Gives further refinement to estimates.

Disadvantage Can be done only where data volume is large. Requires a large amount of work with a large number of triangles to present and analyse the data.

[D6]
LOSS RATIO v CLAIM DEVELOPMENT PATTERNS

The most common general method for reserving is to project the claim development patterns for a cohort of claims, defined by accident, policy or report year. Either the losses themselves can be used (paid or incurred), or an average-and-number of claims type projection.

Perhaps the chief problem that arises with such methods is that very little development information is available for the most recent year's business — yet it is this year that usually contributes the largest proportion of the total reserve. Again, for new lines of business, a very small amount of historical data will be available in order to establish the development patterns themselves. And for reinsurers, the data are often far too scanty to yield these patterns with any reliability.

One way round the problem is to use loss ratio methods. The office's underwriters and rate-makers will be taking in the premiums for each line of business with some expected loss ratio in mind. This loss ratio will be based on past experience of the business, and also the assessment of current trends. In the absence of further evidence, it therefore represents the best starting point for reserving. An initial estimate of the reserve can be calculated simply as:

Premium Income × Loss Ratio — Paid Loss to Date

The advantage of the method is that it gives a natural standard by which to assess the business as it develops. The objection is that the method is partly self-defeating, i.e. it assumes the answer before the run-off even begins. Hence regular monitoring of reserves established in this way is essential.

Combination Methods

An important group of methods combines the loss ratio approach with claim development analysis. For example, loss ratios could be used for the most recent accident years — perhaps the current one and the previous one or two. Then for all older accident years, the switch could be made to claim development factors.

A more sophisticated approach, allowing a gradual transfer from loss ratio to claim development, is at the heart of the Bornhuetter-Ferguson method (see §G). For example, if the paid loss after 3 years of development is estimated to be 75% of the ultimate figure, then a proportion of 25% remains unpaid. But this 25% can be estimated just as well, and perhaps better, as a proportion of the ultimate *loss ratio* figure. The split is in effect as follows:

Overall Loss	=	Loss Paid to Date (from known development)	+	Loss Remaining (estimated from loss ratio)

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[D7]
PAID LOSS v INCURRED LOSS DEVELOPMENT

An important choice in claim development methods is whether to use paid or incurred loss data. In fact the answer is often to use both, i.e. in separate projections. Then the answers can be compared, and any anomalies brought to light. But some decision will still be needed as to which set of figures is the more reliable.

Paid Loss

Paid loss represents the actual payments made on the claims in the cohort. It thus has the advantage of being objective data. But it ignores information from other sources, in particular the case reserves. Such sources, although less objective, may still have their usefulness.

The chief problem with paid loss data is that claim settlement rates can vary from year to year, thus producing distortions in the projection. It is therefore important to make some assessment of payment patterns. For example, claim numbers closed at various stages of development can be calculated as a % of:

a) the number of claims reported (for report year cohorts), or
b) the estimated ultimate number of claims (accident year cohorts).

The stability (or lack of stability) of this percentage will be a useful indicator.

Incurred Loss

Incurred loss (i.e. paid loss + case reserves) makes use of the additional data from the case reserves. These lack full objectivity, it is true, but may be an absolutely vital component. E.g. in long-tail lines such as liability, the paid loss in the early years will be a small proportion only of the likely ultimate loss. It is therefore of little use on its own as an indicator, but with the addition of the case reserves becomes much more relevant.

A possible objection to incurred loss is that it uses an estimate of eventual loss as an *input* to the main estimating process. But this is hardly serious, since the case estimates are essentially *data* from the reserver's point of view.

A key problem with incurred loss is that standards of case estimating can change over the years, particularly as the claims office staff turn over, and as fresh sets of instructions are given to the estimators. Thus evidence should be sought on these points.

A useful point for reserving purposes is that case reserves do not have to be accurate. What is required above all is *consistency.* If the reserver knows that the case reserves are consistently overstated by 10% for commercial property and understated by 15% for liability, he or she can make the necessary correction. But the last thing to do is to ask the claims office to alter its practices, as the consistency would then be lost.

Summing Up

As stated at the beginning, the idea of a stark choice between paid and incurred loss data is deceptive. Often, the reserver should use both, in order to get the maximum information.

[D8]
CLAIM AMOUNTS v USE OF CLAIM NUMBERS & AVERAGE COST PER CLAIM

Paid and incurred loss developments operate on the monetary amounts of loss associated with given cohorts. In some cases, especially in reinsurance, only this information will be available. But very often (in direct writing) numbers of claims are known as well as the monetary losses. Hence projections using average claim size can be developed.

Generally speaking, there is an advantage to be obtained by using average claim projections over relying on loss projections alone. The reserver has more information available, and so can obtain a clearer picture of the business. He or she can for example do separate analyses for settled claims and for reported claims (i.e. open and settled together) and may even be able to develop projections for the group of developing claims (i.e. open and IBNR together). These additional analyses will help towards the final decision-making on the level of reserves.

Thus many variations are possible using numbers and average claims. Another distinction is between using a cumulative basis for the average, and a year by year or incremental basis. The problem in using the year by year average is that the values are much more sensitive to change. At times, they can become quite erratic. The cumulative average, on the other hand, gives a more stable progression, but may fail to respond adequately to new conditions.

Other Notes

A general caveat for average claim methods is that they may be difficult to apply if the numbers of claims in the given cohorts are too low to give stability and credibility to the data.

There is a difference in applying the methods to report year as opposed to accident year data. For accident year cohorts, a projection of the ultimate number of claims will be needed. But for report year cohorts, no projection is needed. The ultimate number is already known — it is the number reported itself, which stays fixed by definition.