# LIFE INSURANCE & WEALTH MANAGEMENT PRACTICE COMMITTEE

## Discussion Note: IBNR

## December 2014

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**Contents**

## 1. Status of Discussion Note

This Discussion Note was prepared by the Life Insurance and Wealth Management Practice Committee (LIWMPC) of the Institute of Actuaries of Australia (Actuaries Institute). It does not represent a Professional Standard or Practice Guideline of the Actuaries Institute.

Feedback from Institute Members on this Discussion Note is encouraged and should be forwarded to either of the following individuals:

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This is the first version of this Discussion Note.

## 2. Background

Incurred But Not Reported (IBNR) reserves are policy liabilities held for the future payment of claims that have been incurred but have not yet been reported to the insurer. For group and, to a lesser extent, individual products, the IBNR reserves are often a large component of the policy liabilities or past claim costs and are therefore material to both valuation and pricing. With the continued growth of Group Insurance business, there is an increasing need for life insurance actuaries to understand available IBNR reserve methodologies. Additionally, there is currently only limited coverage of IBNR reserving methodologies in the Actuaries Institute's Life Insurance specialist course and no comprehensive life insurance guidance on this subject.

## 3. Objective

The objective of this Discussion Note is to provide life insurance practitioners with information on some of the available IBNR methodologies, associated advantages and disadvantages, applications and examples. It also provides references to other available material.

Whilst this Discussion Note outlines issues for consideration when determining IBNR reserves for different purposes and in different contexts, the need to apply actuarial judgment in all situations continues to apply. When faced with new or unusual circumstances, seeking out the assistance and guidance of a more experienced actuary is a recommended course of action.

The main focus of the Discussion Note is the determination of the 'best estimate' of the IBNR reserves, although there is some reference to stochastic methods and some of the references address the measurement of the variance of estimates.

## 4. Scope

This Discussion Note applies to both individual and group business in respect of all life insurance benefits. Specifically, it includes death, total and permanent disability, disability income and trauma benefits.

This Note does not discuss or assess, and is not intended (nor is it to be taken as intended) to have any application to any of the following:

- general insurance policies;
- health insurance policies;
- financial reporting, tax or accounting considerations;
- capital considerations; or
- liabilities or reserves other than IBNR reserves.

## 5. Existing guidance and regulation

IBNR claims are referred to in APRA's Prudential Standard LPS 115 (Capital Adequacy: Insurance Risk Charge) and Prudential Standard LPS 360 (Termination Values, Minimum Surrender Values and Paid-up Values) (LPS 360) and IBNR reserves are reported to APRA in accordance with APRA's Reporting Standard LRS 200.0 (Capital Adequacy Supplementary Information).

There are no other specific references to IBNR claims and/or reserves in other standards, regulations or financial reporting guidance. The reference to IBNR claims in LPS 360 appears in item 10(b), which states that the termination values must include:

> *"the discounted present value of claims incurred prior to the termination date (whether reported or not and taking appropriate account of claims settlement costs)"*.

## 6. Data set and worked examples

A spreadsheet has been developed to accompany this Discussion Note with worked examples of the following methods:

- Basic Chain Ladder Method;
- Bornhuetter-Ferguson (BF) Method;
- Additive Method; and
- Cape Cod Method.

The spreadsheet is provided by way of a link in this Discussion Note. The dataset is fictitious and has been applied in all examples to allow for direct comparison and for ease of understanding. The examples are provided as an aid for users to gain a better understanding of the workings of each method only. Care should be taken when using these examples for comparing the various methods.

## 7. Methodologies

### 7.1 Overview

In determining IBNR reserves, there are many different methods to choose from, each having its own underlying assumptions and parameters. This Discussion Note covers the methods more commonly used to determine IBNR reserves for life insurance in Australia. It also includes other methods – namely, the Additive and Cape Cod Methods – that, whilst not as commonly used in Australia, are used more globally. They also have potential application in life insurance in Australia and should be a part of the tool kit of the life insurance actuary.

The methods that are discussed in this Note are:

- Average Delay Method;
- Ultimate Loss Ratio Method;
- Chain Ladder Method;
- Bornhuetter-Ferguson (BF) Method;
- Additive Method;
- Cape Cod Method; and
- Stochastic Methods.

The ordering above has been quite deliberate and lists the methods in order of increasing sophistication (in broad terms). It should be noted that, along with the increase in sophistication, is a corresponding increase in the amount of claims experience data required for the method to provide reliable results.

All the references included in the Annexure under "General References" cover a number of these methods.

In order to keep this Discussion Note to a reasonable length, and so as not to distract from the main points of each method, the variations available for each method have not been discussed.

### 7.2 Average Delay Method

In the Average Delay Method, the IBNR reserve is calculated by multiplying the estimated average claim delay (in fractional years) by the expected ultimate loss ratio by the annual premiums.

**IBNR Reserve = Annual Premiums x Ultimate Loss Ratio x Estimated Average Delay**

Whilst there are variations to this method, the fundamental principle is that the IBNR is estimated as the claims expected to be incurred over a period equal to the average reporting delay.

This method, at least in its simplest form, assumes that:

(a) past premiums are equal to the current period premium;

(b) past loss ratios are equal to the current period loss ratio;

(c) claim development patterns have not changed; and

(d) the portfolio has been in force for as long as it takes claims to develop.

In summary, the method assumes that the portfolio is mature and stable. In order to ensure that reserves are not overstated or understated, care is needed to consider how to apply this method for: growing or shrinking portfolios; portfolios with worsening experience; and those with increasing delays.

If the Average Delay Method is used in situations where data is not sufficiently developed, it will not be appropriate to use the observed average delay from the data alone, since claims with long delays will not yet be appropriately represented in the overall average. Rather, it may be more appropriate in these circumstances to set the average delay by observation from a larger block of business that is more established. It will also not be appropriate to use the observed average delay where loss ratios, exposure and/or claim delays are changing materially over time.

This method is a relatively simple method and is usually only appropriate to use where the IBNR is not material or data is very limited. A common application of the Average Delay Method may be in estimating IBNR when pricing smaller corporate group insurance schemes or where claims are fully developed after only a few months.

The average delay implicit in more sophisticated methods may be used to monitor changes in results over time from those methods and/or as a broad reasonableness check.

### 7.3 Ultimate Loss Ratio Method

The Ultimate Loss Ratio Method is sometimes referred to as the Budgeted Loss Ratio Method. Belonging to a family of methods referred to as loss ratio methods, this is another of the simpler methods for determining the IBNR reserve. The expected ultimate claims for each period are calculated as the earned premiums for that period times an expected ultimate loss ratio. The IBNR reserve is then calculated as follows:

**IBNR Reserve = Expected Ultimate Claims – Reported Incurred Claims**

The estimated loss ratio will generally be developed based upon one or a combination of the following:

- experience from more developed periods;
- the company's experience for similar lines of business;
- assumptions used in pricing the business in question;
- the experience of other companies with similar lines of business; and
- expected underlying risk rates.

A shortcoming of this method is that it ignores the claims development to date when estimating ultimate losses. For this reason, this method is more likely to be used in financial reporting (that is, valuation) rather than pricing. When used for financial reporting, this method may be more appropriate for a new block of business, or smaller blocks with an insufficient number of claims to determine a credible development pattern.

Since the IBNR reserve is the difference between ultimate claims and reported claims, volatility in reported claims – for example, during earlier development periods – results in volatility of the IBNR reserve.

A further shortcoming is that, since the ultimate loss ratio is 'set' and does not depend on the IBNR reserve, this method can 'mask' changes in the underlying experience, resulting eventually in a step change when the ultimate loss ratio is re-estimated.

Proper consideration must be given as to when the claims are fully developed and the IBNR reserve can be written off, as this method will continue to hold an IBNR reserve indefinitely where reported incurred claims are less than the ultimate expected claims. Conversely, adjustments will be required, or another method will need to be used, if ultimate incurred claims are expected to exceed those implied by the expected ultimate loss ratio and thus the IBNR is too low – at the extreme, due to incurred claims reported to date exceeding those expected.

When using this method, it is also important to consider the impact of changes to premiums and/or benefits over time. If expected loss ratios are applied without recognising material changes, then misstatement of reserves can occur.

### 7.4 Chain Ladder Method

Where there is sufficient claims experience, the Chain Ladder Method (or a variant thereof) is perhaps the most widely used method for determining the IBNR reserve within life insurance in Australia.

The term 'chain ladder' is used to describe the methodology or technique by which claim development or link factors are derived for a set of claims experience.

The key assumption underlying the Chain Ladder Method is that there is a consistent delay pattern in the reporting[1] of claims. The Chain Ladder Method uses historical claims data and reporting patterns to estimate the claims that have not yet been reported.

The starting point for the Chain Ladder Method is the development or run-off triangle. In life insurance, the development triangle usually organises claims data according to the period that the claim was incurred and the delay from the period the claim was incurred to the period the claim was reported. Triangles can either be on a cumulative or an incremental basis. An example of a claim development triangle is shown below (an Excel version of the tables below can be found on the 'TPD tab' of the spreadsheet accompanying this Discussion Note):

**Table 1: Incremental – Number of Claims**

| Incurred Year \ Development Year | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
|---|---|---|---|---|---|---|---|---|---|---|
| 2005 | 13.0 | 60.0 | 39.0 | 22.0 | 14.0 | 19.0 | 14.0 | 12.0 | 8.7 | |
| 2006 | 25.0 | 72.0 | 31.0 | 40.0 | 35.0 | 18.0 | 21.9 | 10.4 | | |
| 2007 | 19.0 | 72.0 | 55.0 | 37.0 | 25.0 | 21.9 | 19.7 | | | |
| 2008 | 47.0 | 117.0 | 63.0 | 48.0 | 44.9 | 36.6 | | | | |
| 2009 | 58.0 | 140.0 | 50.9 | 55.8 | 54.5 | | | | | |
| 2010 | 51.0 | 113.0 | 83.9 | 89.8 | | | | | | |
| 2011 | 25.0 | 126.4 | 132.2 | | | | | | | |
| 2012 | 23.9 | 169.6 | | | | | | | | |
| 2013 | 39.2 | | | | | | | | | |

[1] Or payment of claims (if delays are calculated between incurred and paid).

In the above example:

- each row includes all claims incurred in a particular exposure period;
- each column heading represents the number of development periods between when a claim is incurred and when it is reported. Thus, the entry for 2009,2 of 50.9 incurred claims represents the number of claims reported in 2011 with an event date in 2009;
- development year 0 runs to the end of the calendar year in which a claim is incurred and therefore does not represent a full year of delay from date incurred. A corresponding comment applies to other development years;
- a partial number of claims is caused by applying an acceptance rate factor to any claims that are still pending determination; and
- each diagonal represents the specific year when a claim was reported with the last diagonal representing claims reported in the most recent period (in the above example, all claims reported in the 2013 calendar year).

The development triangle can also show cumulative claims rather than incremental claims as follows:

**Table 2: Cumulative – Number of Claims**

| Incurred Year \ Development Year | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
|---|---|---|---|---|---|---|---|---|---|---|
| 2005 | 13.0 | 73.0 | 112.0 | 134.0 | 148.0 | 167.0 | 181.0 | 193.0 | 201.7 | |
| 2006 | 25.0 | 97.0 | 128.0 | 168.0 | 203.0 | 221.0 | 242.9 | 253.3 | | |
| 2007 | 19.0 | 91.0 | 146.0 | 183.0 | 208.0 | 229.9 | 249.6 | | | |
| 2008 | 47.0 | 164.0 | 227.0 | 275.0 | 319.9 | 356.5 | | | | |
| 2009 | 58.0 | 198.0 | 248.9 | 304.7 | 359.2 | | | | | |
| 2010 | 51.0 | 164.0 | 247.9 | 337.7 | | | | | | |
| 2011 | 25.0 | 151.4 | 283.6 | | | | | | | |
| 2012 | 23.9 | 193.5 | | | | | | | | |
| 2013 | 39.2 | | | | | | | | | |

Based upon the development triangle, the claim development can be represented through a series of factors often referred to as link ratios or development factors. These are calculated as the cumulative claims reported in one period divided by the cumulative claims reported in the prior period. This is shown in the following triangle:

**Table 3. Link ratios or development factors**

| Incurred Year | 0:1 | 1:2 | 2:3 | 3:4 | 4:5 | 5:6 | 6:7 | 7:8 | 8:9 |
|---|---|---|---|---|---|---|---|---|---|
| 2005 | 5.615 | 1.534 | 1.196 | 1.104 | 1.128 | 1.084 | 1.066 | 1.045 | |
| 2006 | 3.880 | 1.320 | 1.313 | 1.208 | 1.089 | 1.099 | 1.043 | | |
| 2007 | 4.789 | 1.604 | 1.253 | 1.137 | 1.105 | 1.086 | | | |
| 2008 | 3.489 | 1.384 | 1.211 | 1.163 | 1.114 | | | | |
| 2009 | 3.414 | 1.257 | 1.224 | 1.179 | | | | | |
| 2010 | 3.216 | 1.512 | 1.362 | | | | | | |
| 2011 | 6.056 | 1.873 | | | | | | | |
| 2012 | 8.096 | | | | | | | | |
| 2013 | | | | | | | | | |
| All periods | 4.322 | 1.485 | 1.264 | 1.163 | 1.109 | 1.090 | 1.053 | 1.045 | 1.000 |
| Last 4 periods | 4.477 | 1.487 | 1.265 | 1.171 | 1.109 | 1.090 | 1.053 | 1.045 | 1.000 |

In practice, it is more common to use the weighted average development factors (with the number of claims being the weight), either over all available incurred periods, or over a smaller, more recent subset of periods. In the example above, the average over the last four periods is shown.

The choice of period depends on whether there should be more weight given to recent experience, or to use a wider period in order for recent fluctuations to be smoothed out. The length of the development period is also an important consideration. Further discussion of these two aspects is included in Section 8.1 below.

Using these development triangles, ratios can then be selected to complete the missing triangle. A fully worked example is included in the accompanying spreadsheet.

Often the claim data available will not be fully developed (that is, not all claims for the earliest incurred period have been reported) or there is not a sufficient amount of data to provide a reliable view of the development for longer delays. In this situation, the ratios for the tail cannot be reliably estimated. Several methods can be considered to determine the tail factors (for example, industry benchmarks, curve fitting etc).

The multiplicative Chain Ladder Method can be oversensitive to variations in emerging experience. For example, it can inappropriately multiply up or down to ultimate variations in reporting to date that are to be expected in scanty data. In this context, such scanty data

may be due either to a small portfolio/low claim numbers or to low early reporting for business with long reporting delays (for example, industry fund TPD business).

In life insurance, the Chain Ladder Method will often be applied to claim numbers rather than claim amounts, with the estimate of unreported claims multiplied by the average sum insured (claims cost for disability income claims) to arrive at the IBNR reserve. When considering the average sum insured/claims cost to use for this purpose, potential and/or actual variations by incurred period or, particularly in the case of industry funds, variation by reporting delay, may need to be taken into account.

### 7.5 Bornhuetter-Ferguson Method

The Bornhuetter-Ferguson (BF) Method, also referred to as the Budgeted IBNR method or the "Expected Loss" method, estimates ultimate claims by taking the development to date as given and calculates the IBNR for each exposure period as:

**IBNR Reserve = Earned Premium x Expected Ultimate Loss Ratio (for that exposure period) x Estimated % of claims not yet reported**

The key inputs to the BF Method for each exposure period are:

- an expected loss ratio; and
- an array of "yet to be paid/reported" proportions by development period.

The expected loss ratio can be established from older experience for the business in question or from other sources such as the pricing expected loss ratio. The expected loss ratio may vary by exposure period and may be refined over time as further experience or other sources of information become available. Given the need for an expected loss ratio as an input, the BF Method may have less applicability for pricing than for valuation. Effectively, the method is circular for a pricing exercise, as the expected loss ratio (an input for the BF Method) is the output from a pricing exercise.

The array of "yet to be paid/reported" proportions by development period can be developed from past experience for the business in question using a variety of methods (including the Chain Ladder Method) or can be taken from other sources (for example, in the case of a new line of business, from experience for business that is expected to display a similar reporting/payment pattern).

The estimate of ultimate claims from the BF Method for a particular exposure period can be expressed as, or derived as, the credibility weighted average of:

(a) the estimate of ultimate claims from the Chain Ladder Method, and

(b) the estimate of ultimate claims from the Ultimate Loss Ratio Method.

For this purpose, the credibility factor applied to the chain ladder result is the assumed proportion of ultimate claims developed for the exposure period. Further, for this equivalence to hold, the parameters used for the BF result need to be consistent with the respective parameters of the Chain Ladder Method and the Ultimate Loss Ratio Method. Hence, when expressed or derived in this way, the BF Method can be said to use all of the data that goes into the previous two methods.

The BF Method may also be based on in-force premium or written premium rather than earned premium, or indeed may be based on other measures of exposure (with suitable modification of the "loss ratio" term).

Variations in actual reporting to date translate directly into the estimate of ultimate claims under the BF Method, but such variations do not result in a compounded impact on the IBNR estimate, in contrast with the loss ratio methods and the Chain Ladder Method. Put another way, the Chain Ladder Method could be said to rely purely on past experience, while the BF Method relies partly on expected losses given the exposure, especially at early durations.

Bornhuetter and Ferguson originally proposed the BF Method in their 1972 paper (see Bornhuetter-Ferguson (1972) in the Annexure).

A variation of the Bornhuetter-Ferguson Method is the Benktander/Hovinen (BH) method, which tries to make a credibility compromise in the determination of the IBNR reserve between the Chain Ladder Method and the BF Method by weighting them together based on the assumed proportion of known and unknown claims for each exposure period.

The BH method is named after Gunnar Benktander (Benktander 1976) and Esa Hovinen (Hovinen 1981), who independently invented it. The BH method is also referred to as the "Iterated Bornhuetter Ferguson" method or "Blended IBNR" method, although the latter label is also applied to other methods.

### 7.6 Additive Method

As for the Chain Ladder method, the Additive Method seeks to complete the missing triangle (that is, estimated future claims reporting) based on the development or run-off triangle. In contrast to the Chain Ladder Method which can be said to use a multiplicative approach, the Additive Method is based on the increments or additions to cumulative reporting to date for each development period.

The Additive Method is also known as the "incremental loss ratio" or "loss ratio development" method. The Additive Method is based on the hypothesis that claims paid/reported in a particular development period (when expressed relative to an exposure measure) are the same for all exposure periods. By contrast, the Chain Ladder Method predicts losses for a particular development period for a particular exposure period as a multiple of cumulative losses for that exposure period up to the previous development period.

Under the Additive Method, the IBNR reserve for each exposure period is calculated as the sum, for all outstanding development periods, of:

**IBNR reserve = Additive assumption for development period x exposure measure for the exposure period**

Where premium is used as the exposure measure, the resulting additive assumptions are expressed in loss ratio points of development for each development period. In this case, the additive assumption for a particular development period (d) would usually be determined as:

**Additive assumption (development period (d)) = The average amount of claims paid (or expecting to be paid in the case of pending claims) across all (or a selected number of) exposure periods, for that development period**

When there has been historical repricing, it is necessary to strip out repricing effects in the premium by the application of a scaling index. A similar approach, involving construction of a scaling index, may be used where the method is applied to numbers of claims rather than the amount of claims. Where the method is applied to numbers of claims, the resulting estimated future claim numbers would then be applied to an average claim amount to determine the IBNR reserve.

The Additive Method is less sensitive to variations in emerging experience than some other methods (for example, the Chain Ladder Method) since the IBNR reserve under this method for a particular exposure period is not directly affected by claims that have been reported to date for that exposure period. On the other hand, where the additive assumptions are based on experience up to a recent date, it is more sensitive to emerging experience than the BF Method, which is likely to be based on an ultimate loss ratio determined longer ago (for example, at pricing).

The Additive Method can be modified to incorporate trends or apparent step changes in claim incidence. Trends can be allowed for by deriving the additive assumption by a linear regression rather than by an average. A higher order polynomial could also be used, but a minimum amount of data would be required for a credible outcome. Step changes can be allowed for by deriving one additive assumption for exposure periods before the step change and another for exposure periods after the step change.

### 7.7 Cape Cod Method

The Cape Cod Method is similar to the BF Method; however, instead of the ultimate loss ratio being an input assumption, it is estimated based on claims reported to date. Unlike the BF Method, there is one ultimate loss ratio used across all exposure periods.

This is determined by totalling claims reported to date across all exposure periods and dividing by the sum of premiums "used" for these exposure periods. The premium "used" to date for a particular exposure period is calculated as the premium for the exposure period times the assumed percentage of ultimate claims developed to date for that exposure period.

In this way, the estimated ultimate loss ratio is based on all experience to date and is averaged across all exposure periods. It can be seen that the array of "yet to be reported"/ "developed to date" percentages of ultimate claims is a key input assumption, as for the BF Method.

The IBNR reserve is then calculated in the same way as in the BF Method. Expressed another way, the IBNR reserve for a particular exposure period is calculated as:

**IBNR reserve = "unused" premium times the estimated ultimate loss ratio**

The following simplified example illustrates the method:

**Table 4: Assumed % development to period**

| Assumed % development to period: | | |
|---|---|---|
| 1 | 2 | 3 |
| 40% | 75% | 100% |

**Table 5: Cumulative Claim payments**

| Exposure Period | Premiums | Cumulative claim payments to development period: | | | "Used" Premium |
|---|---|---|---|---|---|
| | | 1 | 2 | 3 | |
| **1** | 140 | 60 | 100 | 130 | 140 |
| **2** | 230 | 80 | 180 | | 172.5 |
| **3** | 280 | 110 | | | 112 |
| **Total** | | | | | **424.5** |

Estimated ultimate loss ratio = (110 + 180 + 130)/424.5 = 98.9%

**Table 6: IBNR reserve calculation**

| Exposure Period | IBNR Reserve | Comments |
|---|---|---|
| **1** | 0 | = 98.9% x (140-140) |
| **2** | 56.9 | = 98.9% x (230 - 172.5) |
| **3** | 166.2 | = 98.9% x (280 - 112) |
| **Total** | **223.1** | |

The method can be modified to allow for pricing changes and/or for assumed trends in ultimate loss ratios. In this regard, it is a method that might be used where there is not enough claims experience to use the Chain Ladder Method, but enough claims experience to warrant reflecting some of this in the IBNR reserve estimate.

A further modification is based on a presumption that the ultimate loss ratio for an exposure period is likely to be more similar to exposure periods surrounding it than those more distant. This is allowed for by introducing a "decay" factor to apply to the experience for an exposure period when it is used in deriving the ultimate loss ratio assumption for other exposure periods. The extent to which the decay factor is applied to that experience depends on the number of periods between the exposure periods in question. This is referred to as the Generalised Cape Cod (GCC) method.

As the decay factor approaches 1, the GCC method approaches the traditional Cape Cod method. On the other hand, as the decay factor approaches 0, the GCC method produces a result for each exposure period based solely on its own experience to date (that is, as per a loss development method, such as the Chain Ladder Method).

### 7.8 Stochastic methods

Stochastic methods are becoming more popular for capital modelling, however they are not commonly used for reserving purposes. With stochastic claims reserving, the output is a probability distribution of ultimate claims, as opposed to the single reserve estimate in deterministic models. Additionally, while the stochastic models calculate the ultimate claims, the deterministic models estimate the expected value of claims that have already been incurred in a prior period. There are different types of stochastic methods such as the Bootstrap method (see England and Verrall (2002)), the Mack method (see Mack (1993)) and the Parodi method (see Parodi (2012)).

The Bootstrap method uses existing claim development factors and separates them into an underlying pattern and random noise. The distribution of the random noise is assumed to be consistent at all points in the development factor triangle and is shuffled around randomly to produce the results. The underlying distribution of ultimate claims can then be determined. A range of possible results can then be associated with a specific probability.

The Mack method fits the normal and lognormal distributions to the mean and standard error of reserve estimates. The method is applied to each exposure year and a full distribution of ultimate claims is derived.

The Parodi method adopts an approach which uses individual claims information to determine a separate model for the frequency and severity components of IBNR claims. A Monte Carlo simulation is then used to combine the components to determine the aggregate loss distribution.

Some of the challenges presented by stochastic models include them being perceived as 'black boxes' which can produce illogical results and be very sensitive to the data inputs. These models are complex and often inflexible in terms of applying expert judgment to them. Interpreting and communicating the results to key stakeholders presents another challenge for the actuary.

The introduction of Solvency II in Europe is likely to lead to greater incorporation of stochastic models for reserving purposes and consequential further development of such methods.

### 7.9 Strengths/weaknesses of each method

The following discussion of the strengths and weaknesses of various methods is based on a relatively "pure" application of each of the methods. In practice, the application of a particular method may be modified or adjusted to address the weaknesses of a "pure" application of the method in the particular circumstances.

When comparing methods, practitioners could consider the pros and cons associated with each method and the circumstances where different methods are more or less suitable. Some aspects to consider are:

- complexity vs simplicity;
- small growing portfolio / stable portfolio / declining portfolio;
- variability in claim size;
- long vs short reporting delay;
- sensitivity to recently reported claims;
- sensitivity to outliers or changes in benefits or changes in premium rates; and
- dependence upon input parameters.

| Method | Strengths | Weaknesses |
|---|---|---|
| **Average Delay** | – Simple, easy to understand. | – Does not provide insights into what is going on.<br>– May need adjustments especially for growing/ shrinking portfolios, changing claim rates or changing delays. |
| **Ultimate Loss Ratio** | – Simple, easy to understand.<br>– May be used in situations where there is a reliable estimate of the ultimate loss ratio, but not the average delay. | – May not reflect recent experience. |
| **Chain Ladder** | – Uses updated claim delay data to inform the reserve.<br>– Provides more insight into what is going on than the Average Delay and Ultimate Loss Ratio Methods. | – May be oversensitive to the latest development 'diagonal'.<br>– Is volatile in the recent exposure periods where IBNR reserves are the biggest.<br>– Makes no estimate of ultimate claim rates. |
| **Bornhuetter-Ferguson (BF)** | – More stable than the Chain Ladder Method. Provides a smooth estimate whilst incorporating information as it becomes available, placing more weight on credible information. | – If the claim development factors are not actively updated,[2] then less sensitive to emerging trends than the Chain Ladder or Additive Methods.<br>– Is reliant on a previous estimate of the experience. This may not be available or reliable. |

[2] Note that either the Chain Ladder or Additive Methods can be used to update the claim development factors for the BF and Cape Cod Methods.

| Method | Strengths | Weaknesses |
|---|---|---|
| **Additive** | – More stable than the Chain Ladder Method. | – Less sensitive to emerging trends than the Chain Ladder Method. |
| **Cape Cod** | – Uses the claims experience to set the ultimate loss ratio, which may make the IBNR estimate more 'attached' to the business in question than the BF Method.<br>– More stable than the Chain Ladder Method. | – If the claim development factors are not actively updated,[3] then less sensitive to emerging trends than the Chain Ladder or Additive Methods.<br>– Does not allow for an "a priori" estimate of the ultimate loss ratio. |
| **Stochastic** | – Informs users about statistical credibility, and the range of reasonable estimates.<br>– Can include more information than the other methods, particularly if advanced methods are used to estimate claim delay functions. | – Complicated, not well understood. |

## 8. Considerations in setting parameters

### 8.1 Claim development period

Many of the methods in Section 7 require assumptions about the pattern of future claim delays in one form or another. These assumptions are usually derived from the experience directly related to the business being valued or priced. The main decisions are:

- what level of granularity to group the experience data by (that is, the main product group or product classes etc);
- which period in time to take the experience from; and
- the length of the incurred and development periods to use (for example, quarterly, half yearly, yearly) – noting that different periods can produce very different results.

Where these assumptions are based upon past experience, it is important for the actuary to have a good understanding of this experience to allow for changes to delays over time and produce a 'best estimate' of future claim delays. Issues that may be relevant to take into account include but are not limited to:

[3] Refer previous footnote.

- past administration delays/backlogs;
- changes in claims processing, claims administration processes generally and/or claims reporting processes;
- changes in date definitions;
- acceleration/ deceleration in reporting delays;
- changes in benefit design;
- changes in mix of business;
- changes in member communication practices;
- changes in member awareness;
- more recent emergence of late claims;
- changes in other environmental factors (for example, greater lawyer involvement in TPD); and
- legislative changes.

When choosing the experience upon which to base the claim delay assumption there is often a trade-off between choosing:

(a) a shorter period with the most recent and relevant experience albeit with potentially less credibility; and

(b) a longer period with more experience to provide a stable and credible view albeit with a reduced sensitivity to the most recent experience.

An initial study of the past experience should be carried out to detect if there are any calendar, development or event period effects or trends.

### 8.2 Pending claims

Where the IBNR reserve is being developed based on date notified (rather than date paid), it is appropriate to include all claims that have been classified as "reported" that have not yet been declined in the claim development triangle (that is, those that are not yet admitted or still pending). An acceptance rate would be applied to the pending claims for inclusion in the development triangle. The acceptance rate is based upon the proportion of claims expected to be admitted. The acceptance rate is simply the complement of the decline rate (that is, acceptance rate plus decline rate equals 1).

In assessing the decline or acceptance rates, consideration should be given to the materiality of the assumption, the application of the assumption (that is, pricing or financial reporting) and the applicability of the past measurement of the company-specific decline rates. Acceptance rates (particularly for TPD) often differ by delay until claim notification and can also differ by delay since notification.

### 8.3 Tail considerations

There are many situations where the experience available is not fully developed (that is, there are still claims being reported for the oldest exposure periods in the available data). In addition, the data available for older development periods may also not be credible due to limited exposure or be considered not relevant to the more recent exposure periods. In these situations, assumptions need to be made about how the older unreported development periods will develop.

In these situations, the development for older periods will need to be derived by some other means. Two ways that this is commonly done are:

- base the development pattern on experience that is available elsewhere; and
- fit a curve to the run-off pattern around the end point where the experience is still used. A common type of curve fitted is an exponential curve.

### 8.4 Use of IBNR reserves

IBNR reserves are used in both pricing and valuation. Whilst there are many similarities between pricing and valuation, there are some differences as well. Valuation is generally about setting the IBNR reserve for all past periods, whereas pricing involves setting the IBNR reserve for past periods in order to predict where experience will be in future periods. This results in a number of differences, including:

- pricing analysis often chooses a shorter period to analyse the experience. This may mean excluding later periods with large IBNR reserves;
- valuations are required to estimate the reserves right up to the valuation date. This could involve roll-forwards or other approximation techniques in between detailed studies; and
- valuations will also be required to estimate IBNR reserves for all periods, even when development is very early, as opposed to pricing which may just exclude this period.

Given these differences, the methods applied for valuation may focus more on estimating the IBNR reserve in periods early in the development, whereas pricing may focus on choosing a period where it is expected experience is credible and can be used to project future loss ratios or claim rates.

### 8.5 Discount rates

The application of a discount rate (or rates) in the calculation of an IBNR reserve is dependent upon the purpose, nature and materiality of the IBNR reserve. When choosing whether to use a discount rate, and the specific discount assumption to apply, consideration should be given to the following:

- whether discount rates are prescribed under any relevant accounting, actuarial or other standards;
- the purpose for which the IBNR reserve is being calculated;
- the length of the delays expected in the IBNR reserve;
- the materiality of the impact on the final result of the IBNR reserve (for example, the IBNR reserve may be sensitive to the level of discounting, but in the context of the overall result the IBNR reserve itself may be immaterial); and
- whether a single discount rate is appropriate or a yield curve approach is required.

This list is not all-inclusive and appropriate care should be taken in the selection of discount rates.

If there are significant delays between reporting and payment of claims, then further discounting may need to be applied.

## 9. Data

### 9.1 Collection

As is the case for determining all reserving estimates, the quality and completeness of the underlying data is vital for the overall accuracy of the IBNR reserve. In normal circumstances the policy and claims data are obtained from a number of administration or claims systems and the data is collected over a number of years. Therefore, it can be expected that there may be missing, erroneous or inconsistent data in the resulting data extracts.

In the first instance, data should be reviewed for accuracy and completeness with consideration of the following aspects:

- reconciliation of claim data to the paid claims data in the general ledger and as reported in the financial statements;
- reconciliation of the claim data to the claim data used for prior period analysis; and
- reconciliation of the "incurred date" assigned to claims for reserving purposes to the contractually-determined incurred date for benefit purposes.

Additionally, the data should be reviewed for reasonableness and appropriateness, including the following considerations:

- data field definitions;
- the completeness of the necessary data elements, including the internal and external consistency of the elements;
- contract provisions, plan documents, and reinsurance treaties to establish context of data;
- any known, material limitations of the data;
- identifying and understanding questionable or inconsistent data values; and
- identifying relationships of data that are materially inconsistent.

Where the data has been provided by a third party, the above reviews should still be performed and the checks carried out by the third party should also be provided with the data.

### 9.2 Definition of "reported"

A key definition is what is meant by "reported" and consistency with the underlying data. There are many different interpretations of when a claim is reported, some of which are:

- when a phone call is received by the insurer/administrator asking for a claim form to be sent;
- when the claim form is received by the administrator;
- when the claim form is received by the insurer;
- when the claim form is received by the claims department of an insurer; or
- when the eligibility of the claim has been checked.

It is important that, whatever definition is used, the date reported is recorded accurately and consistently. Note that there may also be differences between how a finance team, pricing team and claims team report these statistics within an insurer.

Any changes over time in the basis on which a claim is recorded as "reported" or in the overall claim reporting process need to be carefully considered. If the effect is significant, specific allowances may need to be made in the IBNR reserves determination so that the IBNR reserve is consistent with the basis on which claims are expected to be recorded as "reported" going forward. Such changes can also affect the appropriate decline rate assumption going forward.

### 9.3 Definition of "incurred date"

The "incurred date" is the date on which a claim is deemed to have "occurred". This date is important for both determining the basis of claim payment and for developing the IBNR reserve. The incurred date may have a number of definitions or interpretations, such as date of accident or death. It should, however, be established consistently with the language and spirit of the policy contract. Care should be taken to ensure that the data on the administration system is being interpreted correctly and consistently with the way in which it was input. The incurred date is especially important as the basis for using the development methods to calculate claim reserves.

### 9.4 Claim numbers or amounts

Most IBNR reserving methods can be done using either claims numbers or claim amounts. A key advantage of using amounts is that it incorporates both the number of claims and the sum insured of claims, whereas using claim numbers requires the average claim size to be estimated as a second parameter. On the other hand, a key advantage of using claim numbers is that it can provide the actuary with greater insight as to the claim patterns or behaviour and models the underlying process under which claims arise.

Using claim numbers is also advised when the sum insured range is large or when the result can be volatile (that is, business with immature claims development). It is also possible to then apply different average claim sizes by duration. This is useful for some group schemes where the benefit scale is larger for younger members who tend to have longer claim notification delays. This is also particularly important for disability income, where the average claim size can vary significantly by duration reported (due to being past the higher termination rates expected in the earlier durations of a claim). One approach is to run the Chain Ladder Method using both claim numbers and claim amounts and then, by comparing, ensure the results yielded are consistent (one result will serve as a reasonableness check of the other).

### 9.5 Grouping

The grouping of the data into the main business or product classes and risk subgroups is a significant factor in the determination of reserve estimates. For each subgroup, the larger it is and the more homogeneous the risks it contains, the greater the degree of statistical stability of the estimate. If sufficient data is available, then grouping claims at a lower level will allow for specific features of the claims or underlying risks to be taken into account and should result in more accurate estimates.

There is a trade-off, however, between attaining more homogeneity of risks and maintaining the statistical credibility of the reserve estimate. A sound knowledge of the underlying business in respect of the operational characteristics (such as marketing, underwriting and claims management) is also an important input to data segmentation decisions. The actuary must find, and be prepared to justify, a suitable compromise.

# 10. Methodology considerations

## 10.1 Changing methodologies

There may be occasions where it becomes necessary to change methodology. This is particularly the case when using simplified methods for a smaller portfolio that grows to a substantial size. When changing methodologies, a number of items should be considered:

- the appropriateness of a range of methodologies;
- the reasons that precipitated the change (that is, volumes, volatility, experience);
- the impact of changing the methodology at a particular point in time; and
- for pricing, it may be worth considering providing the results on both the new and old methodologies for a transition period.

## 10.2 Calculation of IBNR reserves between studies

Calculation of an IBNR reserve using the methods above can be a cumbersome and lengthy process. It may not be feasible to complete a full review to coincide with the financial reporting date when determining an IBNR reserve for valuation purposes (pricing is not usually concerned about a particular reporting date so this is not relevant for pricing). A method may be required to roll the last full study forward to the current financial period.

For example, if using the Bornhuetter-Ferguson Method to determine the IBNR reserve, the outstanding proportions at each delay period are determined. These outstanding proportions can then be used to apply to the premiums to determine the IBNR reserve. For this method to work, premium needs to be separated into small periods, as the outstanding percentage changes significantly with the passing of time. The loss ratio can be obtained from the latest IBNR study.

Where simplified approaches have been used, there may be simple ways of rolling forward the IBNR reserve (for example, for the average claim delay approach, it may only be necessary to update the in-force premium volumes).

## 10.3 Methodology combinations

One approach used for Australian life insurance business is a combination of two methodologies; such as the Chain Ladder Method for older, more developed incurred years and the BF Method (or a variant thereof) for the most recent incurred year or two. In some cases, there may be a gradual blending of the two approaches in the recent incurred years.

### 10.4 Considerations specific to disability income/group salary continuance business

As individual disability income and group salary continuance (GSC) claims tend to be reported fairly quickly, IBNR reserves tend to be a smaller proportion of total claims costs for this business compared to, for example, IBNR reserves for industry fund TPD claims. Nonetheless, there are some additional considerations when setting IBNR reserves for this type of business:

- when considering the advantages or disadvantages of choosing claim numbers or amounts (discussed in section 9.4), it should be noted that using amounts (based on estimated claims costs for claims reported to date) is implicitly using the average claim size of claims reported to date and, by extension, the termination rate basis used to determine the Open Claims Reserves ("OCR") for open claims. Since the IBNR reserves are being established for late reported claims, poorer termination experience for these claims might be expected. This may indicate that a different termination basis is appropriate when calculating the average claim size for IBNR claims. The advantage of using claim numbers is that average claim size is an explicit parameter which requires setting separately (and can be considered deliberately rather than implicitly). It is also possible to set up different average claim sizes by delay;

    - to ensure consistency between the IBNR reserve and the OCR (that is, to ensure that there is neither an overlap nor a gap), it is important that the date notified definition for the IBNR reserve calculation is consistent with the timing of establishing the OCR for a claim. Put another way, considering the timeline of a particular claim, it is important to ensure that there is appropriate transition from the claim being included in the IBNR reserve to it being included in the OCR; and

- when comparing current estimated total claims costs results/estimated loss ratios (inclusive of IBNR reserves) with the corresponding results from a previous investigation, it can be useful to separate the effect on the IBNR reserves of changes in termination assumptions from other effects on the IBNR reserves.

### 10.5 Writing off IBNR reserves

Liability for claims is indefinite but, for practical purposes, the risk of claim may become immaterial. It may not be practical to keep track of individual schemes or groups of policies that have not been on risk for extended periods. Methods to deal with this include:

- combining older schemes together, and setting IBNR reserves and monitoring processes as a combined group; and

- for smaller exposures, where there has been an extended period with no claims and no other similar schemes that have reported claims beyond the delayed period, it may be appropriate to set the IBNR reserve to nil.

### 10.6 Excess or outlier claims

Excess or shock claims (particularly their timing, number and amount) can have a material impact on completion factors produced by the Chain Ladder Method and can distort the results generated under some other IBNR methods.

Examples of such claims can include those arising from a catastrophic event (which may have a different reporting pattern), large industry fund voluntary cover claims or, more generally, those outside the "normal" range for the business in question. Such claims can produce significantly different results from analysis on a claim numbers vs claim amounts basis and, indeed, this may be part of the process of identifying them. Care needs to be taken though to consider whether departure from a past "norm" is an outlier or the start of an underlying change (for example, greater prevalence of industry fund voluntary cover claims due to increases in take-up of such cover).

Often the adjudication time and/or reporting delay for these excess claims is longer; thus, when they are paid/reported, they can lower all previous development periods' completion factors or increase the average claim size. In either case, the overall claim reserve produced will be increased. Incorporating the excess claims impact (for example, lower completion factors) is essentially providing an ongoing reserve for a similarly expected excess claim – which may be appropriate, depending on the likelihood of recurrence and the likely recurrence period.

Alternatively, in the rare case that the large excess claim is paid/reported much faster than other claims (and a Chain Ladder Method based on claim amounts is being used), the resulting completion factors will be increased, thus lowering reserves, which may not be appropriate.

The impact of excess claims on the Chain Ladder Method's completion factors could be allowed for by including them at an average amount or by removing them completely from the completion factor calculation. If done in the latter way, the actuary then has two choices:

(a) keep the excess claims in the cumulative paid/reported claims to which the completion factors are applied; or

(b) continue to keep the excess claims removed even from the cumulative paid/reported claims and, thus, adopt another method to calculate claim reserves for future potential payment/reporting of excess claims already incurred.

If (b) is chosen, a possible approach is to include claim-specific excess claim reserves set with help from the claims adjudication staff. Correspondingly, if the "average amount" approach is adopted, then there is a choice between including the excess claims at their full amount or only at the average amount. In the latter case, the excess claim reserves would then be in respect of the excess over the average amount.

A key factor in the choice of whether to remove excess claims from completion factor development is the relative materiality that excess claims have on the block in terms of size, completion factor impact and reserve impact. A further factor in a pricing context is to ensure consistency between the allowance in the IBNR reserve calculation and allowance for excess claims that may be made in another part of the pricing analysis.

### 10.7 Reasonableness checks

As with any actuarial analysis, it is essential to perform some reasonableness checks to provide an indication as to the overall reasonableness of the IBNR reserve that is being established.

High level tests could be conducted as follows:

- chart and compare the claim development factors of a number of different funds of similar type or composition to the scheme in question to see if the run-off patterns are similar and any differences can be explained;
- back-test the adequacy of the reserve by comparing actual IBNR claims to the reserve held in respect of those claims;
- benchmark the average delay periods – between funds and over time;
- compare a number of simple ratios, such as IBNR reserve / premium;
- perform reasonableness checks such as TPD having longer delays than death and disability income; and
- compare total incurred claims (in aggregate and by period) using IBNR's established under different assumptions to test sensitivity and appropriateness.

## 11. Overall considerations

When considering the methods and assumptions to adopt for determining an IBNR reserve, an underlying objective is that the actuarial methods and assumptions should be "forward looking", but informed by the past.

As with many other aspects of actuarial work, application of the control cycle is important to review and refine assumptions between studies. A related aspect is consideration of what new information would be useful to improve the analysis, and seeking to build this data over time.

A useful distinction may be made between the "valuation model" and the "diagnostics". A valuation model that is not overly complicated can be used in conjunction with assumptions that are informed by separate diagnostics, such as analysis of the exposure profile, causes of claims, claim sizes (including duration for disability income claims) etc.

Especially where the IBNR reserve has a significant financial impact, it can be useful as an aid in considering the range of potential variation of future outcomes (that is, sensitivity testing) to consider IBNR reserve calculations on a number of bases, such as different:

- IBNR calculation methodologies;
- lengths of development period;
- experience periods for deriving assumptions – either by incurred period and/or by reporting period (for example, reporting in the last few years); and
- bases of estimating the "tail".

As well as directly impacting IBNR reserve results, such alternative IBNR reserve calculations can affect resulting views on trends.

A consideration relating to determination of the 'best estimate' of the IBNR reserve is whether there is an asymmetrical distribution of potential outcomes. A deterministic approach based on past experience and trends may not necessarily give the 'best estimate' of the IBNR reserve if, for example, there is greater potential for experience to get worse than to improve.

## 12. Portfolio-specific considerations

### 12.1 Step changes in experience

Step changes in experience will impact the IBNR analysis. The Chain Ladder Method, in particular, is sensitive to significant changes in experience and actuaries should therefore look closely to identify if there appear to have been any step changes in development experience and, if so, consider how best to deal with the impact of any such step changes.

The basis of the Chain Ladder Method is that the reporting delays of a book of business are stable over time or, in other words, that there is a stable development pattern that emerges over time until the ultimate number of claims is reached.

If a break in the pattern is observed, it usually means one of two scenarios:

- there is an acceleration/deceleration of claims reporting. In this situation, the ultimate number of claims does not increase; or
- there is a step-change in underlying claims experience. In this situation, there is a change in the ultimate claims rate and ultimate number of claims.

Both these situations will initially manifest themselves similarly – that is, as an increase (more common) or decrease in the number of claims reported in the leading diagonal of the development triangle.

Table 3 from Section 7.4 above (reproduced below for ease of reference) provides an example where a worsening trend may be observed.

**Table 7 (same as Table 3 above): Link ratios or development factors**

| Incurred Year | 0:1 | 1:2 | 2:3 | 3:4 | 4:5 | 5:6 | 6:7 | 7:8 | 8:9 |
|---|---|---|---|---|---|---|---|---|---|
| 2005 | 5.615 | 1.534 | 1.196 | 1.104 | 1.128 | 1.084 | 1.066 | 1.045 | |
| 2006 | 3.880 | 1.320 | 1.313 | 1.208 | 1.089 | 1.099 | 1.043 | | |
| 2007 | 4.789 | 1.604 | 1.253 | 1.137 | 1.105 | 1.086 | | | |
| 2008 | 3.489 | 1.384 | 1.211 | 1.163 | 1.114 | | | | |
| 2009 | 3.414 | 1.257 | 1.224 | 1.179 | | | | | |
| 2010 | 3.216 | 1.512 | 1.362 | | | | | | |
| 2011 | 6.056 | 1.873 | | | | | | | |
| 2012 | 8.096 | | | | | | | | |
| 2013 | | | | | | | | | |
| **All periods** | 4.322 | 1.485 | 1.264 | 1.163 | 1.109 | 1.090 | 1.053 | 1.045 | 1.000 |
| **Last 4 periods** | 4.477 | 1.487 | 1.265 | 1.171 | 1.109 | 1.090 | 1.053 | 1.045 | 1.000 |

Looking down each column in Table 7 provides an indication of the stability (or any trends in) the development factors across incurred years. Specifically, looking at column 0:1, it can be seen that, from incurred years 2008 onward, the column 0:1 development factors are 3.489, 3.414, 3.216 – that is, more or less stable around the 3.4 mark – before they increase to 6.065 and 8.096 for the 2011 and 2012 incurred years respectively. A similar pattern is evident for column 1:2 for the 2010 and 2011 incurred years (that is, from reporting in the 2011 calendar year – as for column 0:1). This is also the case – to a lesser extent – for column 2:3.

Actuarial judgment is required to consider whether the observed development experience represents an increase in claims incidence or a bringing forward of claims reporting. If it is the latter, then using the past development factors without adjustment would result in an overstatement of IBNR reserves.

This overstatement is further compounded (compared to some other methods) as the mechanics of the Chain Ladder Method mean that the cumulative claims reported in the leading diagonal are then multiplied by claim development factors. Unfortunately, there are no simple means of identifying if it is a change in reporting, an acceleration in claims or a combination of both and so dealing with this issue. One way is to 'hand-smooth' the claims in the leading diagonal(s) and use these adjusted claims when calculating the IBNR reserve;

however, this is very subjective, should be well documented and discussed/peer reviewed extensively.

On these occasions, it would be useful to be able to justify the position adopted with, or indeed to develop the position adopted based on, evidence of other contemporaneous events that logically support the observed experience (for example, greater member communications and/or other impacts at that time resulting in higher awareness of cover). However, it should be noted that in many cases it will be difficult to prove conclusively that a direct causal relationship exists.

Given the long delays for TPD claims to fully develop, there may not be sufficient data to even be confident about the ultimate number of claims, as not all of the "tail" may be present in the available data.

A possible approach in these situations is to use claim development factors developed from a proxy book or portfolio that might reasonably be expected to have similar characteristics to the target portfolio (for example, a similar industry).

Another example of a step change in experience is where there is an increase in the number of claims reported at later durations. (Of course, higher reporting at early durations as well as at long durations can occur at the same time – as was the case for many industry funds' TPD experience during the years from around 2012, perhaps due to factors such as increased plaintiff lawyers' involvement.)

Where there is an increase in the proportion of claims reported at later durations, the immediate impact may be to increase the average observed claim notification delay of the portfolio. Actuarial judgement is required to determine if this lengthening of average delay represents a 'permanent shift' for the portfolio – which implies that the experience prior to this was less mature than previously appeared to be the case – or if this represents a somewhat temporary change in claims reporting.

Some factors that can lead to a change in reporting pattern are:

- a change in the way claims are recorded by the insurer/administrator;
- any event leading to greater member awareness of their cover (for example member statements); and
- the state of the economy, particularly the rate of unemployment.

### 12.2 Claims administration disruption/backlogs

Administration disruptions/backlogs impact the development pattern of the claims. Such impacts may often be observed as the slowing down of development and then a corresponding pick-up in the following period. Where there is evidence outside the IBNR analysis (for example, reports from administration teams) that administrative delays are

occurring, careful consideration of the experience is needed. Depending on the experience, different approaches will be required, some of which are:

- removing the recent experience where the back logs have been generated;
- where a back log and catch-up are clearly evident in the data, removing the diagonal of development impacted by administration disruption;
- for pricing, considering altering the analysis period where there are concerns about the quality of data/development patterns;
- adjusting the raw data, where claims have been clearly identified as those impacted by an administration disruption; and
- using an alternative date, for example:
  - reinsurers may have a "reported to the reinsurer date" and a "reported to the cedant date". If the administration delay is with the reinsurance reporting, the cedant date could be used with an average reinsurance delay; and
  - insurers may record multiple dates for a claim (for example, first contact with the claimant or the date the claim form was received).

As administration delays can materially impact the estimate for IBNR reserve and ultimate experience, it may be necessary to conduct a number of sensitivities on different approaches, especially when directly adjusting the data. This will help the actuary come to an informed view of the appropriateness of an approach and the significance of the decision.

### 12.3 Growing or diminishing blocks

Applying historical data to estimate future claims results is effective when a block of business is in the middle 'maintenance' phase, where the size of the book remains fairly constant. There are certain challenges when the book is rapidly changing in size, either growing or running off.

In general, when a product is first issued and there is no claim history on which to base a reserve, reserve estimates are often based upon the pricing loss ratio using the Ultimate Loss Ratio Method or the Bornhuetter-Ferguson Method. If there are similar products in the company's portfolio, the claims experience from those products may be used to help inform the level of reserves for the new product. This method will continue to be applied until the block of business reaches a size such that its own data is deemed credible.

When the block of business is decreasing in size, new challenges arise. The key issue becomes credibility of the data. When volumes of data decrease and credibility becomes a concern,

the Chain Ladder Method may generate volatile results and exposure methods may again have to be used.

A further complication arises due to worsening experience of the group as the business gets less healthy as the healthy insureds lapse. This in turn drives up rates and expenses which need to be accounted for when calculating reserves, particularly for the recent incurred periods.

### 12.4 Premium/rate changes

Reserve methods that use premiums, such as loss ratio methods, are directly affected by premium changes. When applying loss ratio methods, the actuary needs to be aware of, and adjust for, premium rate changes from the implementation date. This is done by adjusting the loss ratio used in the IBNR reserve calculation for incurred periods after the premium rate change for the effect of the change. Premium changes, especially if they affect different blocks differently, may also affect the demographic makeup of a block through possible anti-selection and growth rates.

### 12.5 Benefit changes and average claim size

The majority of reserve methods will need to make adjustments for changes in benefit levels. Any type of benefit structure change could result in the average claim size moving in one direction or another. Depending upon the type of benefit change, historical averages may no longer apply. In this case, in the initial periods after the benefit change, the reserve estimate may need to be calculated using another method. Another alternative is to initially base the average claim size after the change on the expected relationship (for example, from pricing) to the average claim size before the change.

The trend in average claim sizes by development delay may also need to be considered. Some group schemes display clear trends in average claim sizes by development delay. The trends vary by group and could be influenced by things like benefit scales. Taking this into account could impact the overall estimate of the IBNR reserve.

## Annexure: Further reading

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**END OF DISCUSSION NOTE**