

## PROFESSIONAL INDEMNITY INSURANCE

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### 1. INTRODUCTION

#### *Recent Developments*

RECENT years have seen many changes affecting the market for professional indemnity insurance. The law is changing, widening the scope of liability. The insurance market is changing, with more mutuals and captives being formed. The price and availability of insurance are changing, too.

The internationalization of professional firms has introduced new problems, with claims being brought in the jurisdiction perceived as most favourable to the claimant. The broadening range of services offered by individual firms, and the consequent growth of truly multidisciplinary firms, can only make the situation more complex.

Like many other insurance markets, the market for professional indemnity insurance is cyclical. In the two or three years following 1984 most premiums more than doubled in real terms, and deductibles rose significantly. At the same time capacity fell. The result of all this change is that professionals are considering their indemnity insurance needs in a new light. The main reason for buying insurance is to provide a smooth cash flow. This need has not been met in the recent past.

We therefore believe that now is an appropriate time for the attention of actuaries to be drawn to professional indemnity insurance.

#### *Scope*

In this paper we give a brief description of professional indemnity insurance today, mainly from an actuarial viewpoint. We hope that what we have to say will be of interest to actuaries, both from a professional point of view and as consumers.

There is a great deal which could be written on the subject which time and space have forced us to omit. We have not addressed the legal problems of defining liability, and we have limited our discussion on the whole to the U.K.

We start by considering what is meant by professional liability insurance, and giving a brief overview of its market and characteristics. We then consider ratemaking and reserving, concentrating more on the principles to be followed and the problems which may arise than on specific details. The penultimate section discusses alternatives to conventional insurance, and we finish by considering what the future may hold.

## 2. DESCRIPTION OF PROFESSIONAL INDEMNITY INSURANCE

### *Definition*

According to Jess,<sup>(1)</sup> professional indemnity insurance (PI) is an insurance which indemnifies the insured professional against pecuniary loss arising out of the professional's negligent act, error or omission which causes loss to be suffered by his or her client or a third party. This is the definition we shall use.

The above definition raises several points.

Firstly, what is a professional? Most people have some idea of what they mean by the term, but find it difficult to define precisely. A dictionary (Collins) gives the following definition of a profession: "An occupation requiring special training in the liberal arts or sciences", and defines a professional as "A person who belongs to or engages in one of the professions". Another meaning is "A person who engages in an activity with great competence". Perhaps not all professionals need insurance!

For this paper we will say that a professional is an individual who performs a service for a client. The service is not the provision of a physical product, but the professional's advice or expertise in a particular field. If we use this definition, professional indemnity insurance is analogous to products liability insurance taken out by manufacturers of goods.

Pecuniary (that is, financial) loss in this case includes damages awarded by a court against the professional. Indeed, a large proportion of the claims under PI insurance involve the claimant's suing the insured for damages. As in most other types of insurance, no more than the amount of the loss suffered by the insured may be recovered from the insurers. The costs of the insured professional arising out of the claim (for example legal costs) are also covered.

Professional indemnity insurance does not in general extend to losses incurred by the insured (rather than by a client or third party) because of his or her own negligence or that of an employee.

Different professions refer to professional indemnity insurance by different names. For example, malpractice insurance is often used in the medical profession and some professions have Errors and Omissions (E&O) cover. Other terms used are professional liability insurance and professional negligence insurance. There is little or no practical difference between the concepts involved and in this paper we shall refer to them all as PI.

There are many variations on the cover provided under PI policies. There are however some generalizations which can be made.

### *Claims Made Cover*

By far the most common form of cover now available is for claims made during the policy period. Cover for claims arising from loss or damage occurring during the policy period is now virtually unobtainable for many professions. As with many things in life the covers provided are not this simple in practice, and there are variations on the basic themes.

Firstly, for claims made cover the incident giving rise to the claim must have occurred after the 'Retroactive Date', which will be defined in the policy. The retroactive date is often the original effective date of the policy, but may be earlier, in which case we say that 'Prior Acts' coverage is provided. Some policies also only cover claims which are reported within a certain period after the date the incident occurred. This is known as 'Limiting Reporting', and is the same as having a moving retroactive date.

Even after a professional retires or stops practising for any reason claims may still be made relating to incidents which occurred before retirement. Insurance cover is therefore still needed. The way this is done is to provide 'Tail Cover'. For a single premium, the professional may insure claims made during an extended reporting period, as long as the incidents from which they arise occurred before the retirement date. Many claims made policies guarantee the availability of tail cover but do not guarantee the rate to be charged.

Appendix 1 develops some mathematical relationships between risk premiums for occurrence and claims made covers. It is easy to see that the total risk premium paid must be the same on the two bases, as the total risk is the same, if tail cover is included and the time value of money is ignored.

It is not easy to say whether claims made is 'better' than occurrence for either the insurer or the insured.

For the insurer, the main advantage of claims made cover is that there is better control over the rates being charged. There are several contributory factors to this. Firstly, the possible delay between the period of cover and the final payment is less, as the delay between the incident's occurrence and its being reported is eliminated. Secondly, the final cost of claims reported in a period is likely to be more consistent than the cost of claims arising from incidents occurring in a period, as the range of settlement dates will be less. Because the development of case law is such a crucial factor in professional indemnity insurance, the insurer should be able to judge settlement levels better (and hence rates) if the length of the tail is reduced. Even when it comes to setting the rates for tail cover, there is much more information available to assist in the ratemaking process.

Because of the shorter tail of the claims made cover, the insurer will earn less investment income on the premium and reserves. This may or may not be an advantage, depending on the extent to which investment income is allowed for when setting the premiums. Indeed, the accuracy with which investment income is allowed for makes a difference. If investment returns are assumed to be higher than they turn out to be in practice, the misjudgement will be less significant on the shorter tail of claims made.

The claims made form is generally not popular with insureds. They prefer the peace of mind given by an occurrence policy, knowing that they have insured all their past acts. With claims made cover, the effect of insurance becoming unavailable in the future is to leave them liable for future claims for incidents which have already occurred. It would be interesting to see what value would be

placed on this peace of mind if occurrence cover was available as an alternative in the market.

There is also the question of equity. There are several possible causes of a deterioration in claims made experience and a consequent rise in rates. A series of events occurring in a particular period may come to light, giving rise to an increase in claim frequency. The frequency may also rise due to an increased propensity to claim, or to a change in the legal definition of liability. Also, the levels of awards may rise. It is usually difficult to separate the effects of the different causes. A general increase in rates for all insureds may be inequitable between the generations.

This problem of equity is not peculiar to claims made coverage, as there is a similar problem in reverse with occurrence coverage.

There are certainly some insureds who are attracted by the generally lower premiums of the claims made form (see Appendix 1) who do not fully appreciate the differences in cover provided. In particular, although claims made premiums are generally lower than occurrence premiums, they are paid over a longer period.

### *Common Exclusions*

In all cases below where it is stated that something may be covered by an extension there are some schemes which provide the cover without an extension.

- (i) *The policy deductible.* Some schemes offer the insured a choice of deductible, with the premium adjusted accordingly, whereas others have a fixed deductible for all insureds. The deductible may be applied to each and every claim, or to the aggregate claim amount.
- (ii) *Libel or slander.* An extension to the policy may be available to cover these.
- (iii) *Dishonest, malicious, fraudulent, criminal or illegal acts.* Dishonesty of the partners or employees may be covered by an extension.
- (iv) *Insolvency of insured.*
- (v) *Product liability is covered under a separate policy.* This liability could arise for professions involved in, for example, the building trade who may be involved in the design of certain components.
- (vi) *Cost of replacing lost or destroyed documents.* The cost of the actual physical replacement (paper, ink, retyping etc.) is usually covered but the costs arising from the loss or destruction of the documents or replacing the information lost or destroyed are not unless specific provision is made.

### *The Market—Buyers*

The buyers of PI include individuals, firms, groups of firms and professional associations. The organization of the particular profession determines whether PI is bought on an individual or group basis.

The following list of professions gives some idea of the diversity of the market.

Accountants	Insurance Brokers
Actuaries	Lloyd's Members Agents
Architects	Lloyd's Underwriters
Barristers	Management Consultants
Dentists	Nurses
Design Consultants	Patent Agents
Doctors	Shipbrokers
Engineers	Solicitors
Estate Agents	Surveyors
Independent Intermediaries	

Indeed anyone who claims to give professional advice or is described as a consultant may require PI cover.

Many of these have unusual or interesting characteristics as far as PI cover is concerned, and some are discussed briefly below. Many mutuals have been formed in these and other professions. Section 5 discusses mutuals, and Appendix 3 gives a partial list of mutuals which have been formed or are in the process of being formed.

(i) *Accountants*

Some of the large firms of chartered accountants have been much in the news recently because of the large PI claims which have been made against them, for example, in connection with the Guinness affair. There have been international mutuals either proposed or formed for the Big Eight. The Institute of Chartered Accountants is considering making PI cover mandatory for the granting of a practising certificate.

(ii) *Actuaries*

Many actuaries are employed by insurance companies and do not have specific PI cover. It is likely that for such an actuary a claim would be directed against the insurance company rather than the individual actuary concerned. In law, the company is vicariously liable for the errors and omissions of its employees provided the work involved is carried out in the course of their employment with the authority of the company. Insurance companies normally have a general policy covering the errors and omissions of their directors and officers, including any actuaries they employ. This is known as D&O (as opposed to E&O) and is similar to PI but the two are not exactly identical. Employed actuaries may or may not have employment contracts which waive claims the employer may have against the actuary.

Specific PI cover is normal for firms of consultants, either individually or on a firmwide basis. Also, insurance company actuaries who have part-time consulting work have to arrange their own PI cover. The Institute's Assistant Secretary handles members' inquiries about professional indemnity insurance.

(ii) *Doctors and Dentists*

PI cover for doctors and dentists is provided by organizations such as the Medical Defence Union and the Medical Protection Society. These are not insurance companies as they do not guarantee to pay claims. However, in practice it is very rare if not unknown for them to refuse to do so. All doctors pay the same premium, with no differentiation by field of practice. This is in sharp contrast to the situation in the U.S.A., where specialities perceived as being especially high risk such as obstetricians may pay many times the premium of a general practitioner.

The cover provided is on a losses occurring basis, putting these professions among the few for which such cover is readily available.

(iv) *Solicitors*

It is compulsory for solicitors to have PI cover for at least £500,000 for each and every claim. The Law Society mutual fund started operations in September 1987 and provides this cover. The previous arrangement, which this replaces, was a master policy organized by the Law Society. The Law Society became worried about the possibility of future renewals becoming difficult to obtain. The lead underwriter on the policy, who had previously guaranteed to complete the slip if necessary, placed a limit of 50% on the proportion they were prepared to write for the September 1986 renewal.

*The Market—Providers*

The commercial market for PI cover is limited, and varies greatly by profession and amount of cover required. A small firm in one profession may be able to get over ten quotations, while a large firm in the same profession or a firm in another profession may only find a single carrier willing to quote.

Probably the major insurers are Lloyd's underwriters, although there are a few companies who write significant quantities of PI business. There are some brokers who specialize in this type of insurance.

A number of professions operate a master policy system. A master policy will be arranged with the underwriters, and premium rates fixed. Insurance is then available to all members of the profession. The insureds are all covered by the same master policy, rather than each having an individual policy with the insurer.

Other professions have no such arrangement, but have come to an arrangement with a broker or brokers who operate schemes for their members. These schemes are usually used by smaller firms, as larger ones often need to enter individual negotiations with the underwriters.

The number of mutuals writing PI for a limited group of participants, usually a single profession, is growing. These are reinsured at Lloyds or in the London company market, although there are a number of foreign reinsurers operating in the field.

*Actuarial Characteristics*

The chief characteristics of PI insurance can be summed up in six words: long tail, low frequency, very skew. These three characteristics have some very important consequences.

Traditionally, to say that a line of insurance has a long tail means that there is a long delay between the period of cover to which the claim relates and the eventual settlement of the claim. The long tail on PI was one of the influences on the emergence of claims made cover.

The period between the occurrence of the incident giving rise to the claim and the eventual settlement can be divided into two shorter periods. The first of these is the period of reporting delay and is the period between occurrence and reporting. The second of these is the period of payment delay and is the period between the reporting of the claim and the final payment.

The introduction of the claims made form has eliminated the first period, the reporting delay, as the period of cover now relates to the time of reporting rather than the time of occurrence. The period between the reporting of the claim and the eventual settlement has not been eliminated and can be more than ten years in some cases, especially if there is a protracted legal battle with many appeals. Thus, even the claims made form has a longer tail than many other types of insurance, and the effect should not be underestimated.

Although the frequency is low (recently we came across 35 firms paying a combined annual premium of £10 million who had only 50 claims between them in a ten-year period) it appears to be increasing. This may be in part because we are becoming a more litigious society, or because courts are more inclined to make awards than in the past. The average severity also appears to be increasing faster than inflation. However, the frequency is still low enough so that the main problem in most actuarial analyses is lack of data.

The skewness means that a large proportion of the claims reported are comparatively small. There are, however, a few very large ones. This variability exacerbates the problems caused by the low frequency.

### 3. RATEMAKING

*Scope*

There are many different kinds of professional indemnity insurer. One is the commercial insurer operating in a competitive market and aiming to write for a profit. At the opposite extreme is the mutual organization with an effective monopoly of its particular segment of the market, and aiming for a break-even position. A third is the mutual organization operating in one segment of the market on a competitive basis, but aiming only for a break-even position.

In some cases, there is a genuine transfer of risk involved and freedom of movement of risks in and out of the insurer's portfolio. In others these influences do not always apply. Therefore, the detailed considerations in ratemaking will be

different according to which kind of insurer is involved. Nevertheless, the basic principles remain the same in all cases.

In this section we discuss pricing primarily from the point of view of a profit-making organization in a competitive market, but point out where different considerations may apply in other situations. We consider mainly primary insurers, but discuss excess of loss pricing briefly.

### *Objectives*

The overall objective of a commercial insurer is to realize a profit. It is therefore necessary to set premiums so that the overall income from premiums (including any investment income) covers the outgo from claims and expenses (including commission) with a suitable margin for profit. To do this, the insurer must anticipate both the risks that will be covered and the loss and expense costs that will arise from them. Thus the 'top down' approach to premium rating requires a rate level to be established which generates a specific total premium volume, given a specific exposure, coverage and time period.

Relativities of the rates among different insureds are then considered. The purpose of varying rates between insureds is to avoid antiselection in a competitive market. It would not be necessary, for example, in the case of an association mutual which had a monopoly of insurance coverage for the members, except from the point of view of fairness between members.

### *Exposure Basis*

An exposure basis has two purposes: firstly to estimate the expected costs of insuring the risk for a given insured, and secondly to allocate the total charge for cover amongst a group of insureds with similar risk characteristics. These two purposes are linked by the requirement of avoiding antiselection in a competitive market.

The traditional basis of premium rates for professional indemnity insurance in the U.K. is as a percentage of fee income of the professional or firm of professionals. The percentage varies according to the underwriter's view of the insured—taking into account such factors as: the particular profession, the particular firm, the territorial scope of the policy, and any policy limits or deductibles. Thus fee income is used broadly as a means of allocating the cost of insurance coverage among the different insureds.

Since professional indemnity claims are related to professional work done by the insured, the greater the volume of work the greater the probability of a claim, all other things being equal. To a certain extent, fee income measures the volume of work of a particular firm. However, considering individual pieces of work, it seems unlikely that the probability of a claim arising from that piece of work will depend directly on the fee charged for the work. An example of this arises for insurance brokers operating in different markets where commission rates are different. In this discussion the size of claim has been ignored.

An alternative to fee income as an exposure measure, and a basis which is commonly used, is the number of professional staff, possibly with a classification into partly and fully qualified. This measure also measures the volume of work indirectly.

These two measures both have the disadvantage that the original estimate for a policy year may have to be updated, so that a further premium or premium rebate will need to be calculated when the information is available. Staff numbers are likely to be available sooner than fee income. Fee income may have to be apportioned between policy years, and this must be done consistently.

*Effect of Claims Made Cover*

As coverage of professional indemnity risks in the U.K. is almost always on a claims made basis, claims arise from work done not just in the current policy period but also in previous periods. There is therefore a major disadvantage of using either current fee income or current staff numbers as the exposure basis. If all risks analysed and to be insured have similar history, in the sense that exposure in past periods is directly related to exposure in the current period, there is no problem. Unfortunately, there is likely to be heterogeneity among firms which could be significant. Thus, if no adjustment is made to rates, a rapidly growing firm could be charged more than a relatively stable firm for a lower risk.

The following hypothetical example illustrates the point. Table 1 shows a set of assumed claim frequencies by year of occurrence and year of notification. We assume that all claims are of the same size.

Table 1. *Hypothetical example: Claim Frequencies by year of occurrence and year of notification*

Year of Occurrence	Year of Notification						Later	Total
	1	2	3	4	5	6		
1	.3	.35	.2	.1	.05	—	—	1
2		.3	.35	.2	.1	.05	—	1
3			.3	.35	.2	.1	.05	1
4				.3	.35	.2	.15	1
5					.3	.35	.35	1
6						.3	.7	1

A new firm with current exposure of 10 units has expected claims in the current year of 3 (10 × .3). But a six-year-old firm with exposure of 10 units in each year has expected claims of

$$10 \times (.3 + .35 + .2 + .1 + .05) = 10 \text{ (from column 6).}$$

The situation can be corrected by distinguishing between period of occurrence and period of notification in the rating procedure. For example, a firm with

exposures 6, 7, 8, 9, 10 in years of occurrence 1 to 6 has expected claims in year 6 of:

$$6 \times 0 + 7 \times .05 + 8 \times .1 + 7 \times .2 + 9 \times .35 + 10 \times .3 = 8.7$$

This approach can also be used to distinguish between firms which have different retro-active dates for their coverage.

The table can also be used to calculate expected claims for tail coverage. In this case, the 'later' column is used. This column contains the sum of the frequencies with notification delay at least  $n$  ( $n = 1, 2, \dots$ ). If a firm has exposures 6, 7, 8, 7, 9, 10 in years of occurrence 1 to 6, then the expected number of future claims at the end of year 6 is:

$$6 \times 0 + 7 \times 0 + 8 \times .05 + 7 \times .15 + 9 \times .35 + 10 \times .7 = 11.6$$

Appendix 1 gives some algebraic relationships of claims made and occurrence basis premiums.

The disadvantages of the above approach are that it requires a series of rates rather than just one rate; the more cells that one splits the data into, the less reliable each becomes for estimating rates; the information on prior years' exposure may be less reliable than current year's information; and prior years' information may need to be adjusted for trends and different monetary values. If claims are reported with relatively little delay, which may be true for some professions, the error in using current exposure will not be great.

It is common practice to use current exposure for rating, and to use rates which depend on the length of time claims made cover has been in force. On a theoretical basis, different rates should be used for each year of claims made cover less than the reporting pattern. In practice, the coverage is usually assumed to become mature in the fourth or fifth year of cover.

### *Rating Classifications*

Unless an insurer charges premiums which reflect the cost of providing cover, there is liable to be antiselection. Therefore, insurers will be interested in identifying factors which have a significant bearing on the risk.

Some of the more important factors of a professional indemnity risk are:

- Profession—and practice area (or specialization),
- Territory,
- Size of practice.

Factors such as policy limits and deductibles affect the cost of providing cover but are policy factors rather than risk factors.

The profession/specialization determines the type of claim (i.e. bodily injury, physical damage, or financial loss), the type of claimant (e.g. private individual or corporate body), and the type of risk-limitation procedures (e.g. professional codes of conduct).

Territory is crucial, because it determines what is legally a valid claim. It also

influences the claim frequency and amount through social factors as well as the workings of the legal system. For example, there is a great difference between the U.S.A. and the U.K. The U.S.A. has the concepts of strict liability, punitive damages, jury awards, and contingency fees. The U.K. has none of these: negligence must be proved, awards are made by judges and are for economic loss (plus pain and suffering) only, and lawyers are not paid according to the outcome of the trial. The problems of U.S. Casualty business are discussed in Ryan.<sup>(5)</sup>

The size of practice is allowed for to a certain extent in the fee income of number of staff exposure measure. However, small firms and large firms typically have very different clients. In some professions this may be an important distinction. Some underwriters maintain this distinction by not accepting the larger firms in some professions, even on a coinsurance basis with a relatively small line.

#### *Frequency/Severity Approach*

It is often appropriate to consider separately the claim frequency (i.e. the mean number of claims per unit of exposure) and the claim severity (i.e. the distribution of cost of individual claims). Doing this can reveal important information that is not apparent from a study of total claims costs alone.

To be meaningful, the unit of exposure used in analysing the claim frequency should be the same as that used for calculating premiums. If the unit of exposure is to be changed, or if the effect of an alternative measure is to be considered, historical values of the new unit of exposure may either not be available or not reliably accurate.

Frequency measured by the number of claims per £1 million fee income does not seem very natural, but could be used. To be consistent between years, the fee income should be adjusted for inflation. Otherwise there will be a purely inflationary effect on the trend of claim frequencies. No such problem arises when frequency is measured as the number of claims per member of staff.

Typically, professional indemnity business has very low claim frequency. This is unfortunate (for the actuary, at any rate!), because it means that the data will often lack full credibility. It will not generally be possible to derive rates for the finer subdivisions of risks. Some degree of cross-subsidization between risks is therefore probably inevitable.

To derive claim frequencies separately for each year of occurrence and year of notification, claims need to be recorded by date of occurrence and date of notification. For some claims, the date of occurrence may not be easy to obtain. It is conceivable that some claims should be apportioned partly to one year of occurrence and partly to another (or others). If the claim can be identified to a specific piece of work, this may help to apportion the 'blame' appropriately. Because of the existence of and changes in policy limits and deductibles, the claim size distribution is important, not just the mean claim amount.

Professional indemnity claims tend to have a very skew size distribution. There are many moderate-sized claims but also a few very large ones. Because of the low

frequency fitting a distribution curve to claim amounts has a relatively high statistical error. Nevertheless, the lognormal or Pareto distributions seem to be suitable in many applications. Both of these distributions have been applied to economic data in other fields with some success and some theoretical justification. In addition, the statistical properties of these distributions are reasonably well developed, so they are fairly convenient to use. One particularly important feature is that they are reasonably well behaved under the influence of uniform inflation (see Finger<sup>(6)</sup> and Aitchison & Brown<sup>(7)</sup>).

### *Estimating Frequency and Severity*

It is important to distinguish between a loss or potential loss and an insurance claim. In ratemaking it is best to work with 'ground up' losses and loss costs (that is, the full amount of the loss, rather than the claim, including any deductible retained by the insured and any excess over the policy limit which falls back on the insured). Adjustments to allow for the actual deductibles and policy limits should be made at the end.

Variations between insureds and changes over time of deductibles and policy limits together with inflation all reduce the validity of calculations which use only the limited data. Having said this, one cannot work with ideal data if it is not available.

The nominal claims count needs to be adjusted because it may exclude:

- all losses below the per-claim deductible,
- unreported claims that are in total below the aggregate deductible,
- 'pipeline' claims arising because of slow reporting administration,
- losses notified after all cover under the policy has been exhausted and not reinstated.

IBNR claims should not exist for policy periods which have passed the extended reporting deadline (but again poor recording practice may exist). These would fall on later insurance periods. Vexatious claims may be present, and these distort the figures. Although some claims are expected to be settled at zero indemnification cost, they are likely to involve administrative expenses. If possible these claims should be identified and analysed separately.

Claims estimates may not have been made because of insufficient information. However, if the estimates are reasonable, the claim count within a certain layer can be used to estimate the ground-up loss frequency by means of an assumed size distribution. For instance, suppose that there are  $n$  claims recorded in the layer  $A$  excess of  $B$  and that  $p$  is the probability that an individual loss gives rise to a claim in this layer. Then the loss frequency can be estimated by:

$$\left(\frac{n}{p}\right) / (\text{exposure})$$

If the claim count is distributed according to a Poisson distribution, and

individual claim sizes are independent of each other and of the claim count, then the above estimate is the maximum likelihood estimate of the Poisson frequency.

This estimate does not depend on the size of the individual claims except that they fall in the stated layer. Unless the total cover is exhausted, a claim will fall in the layer  $A$  excess of  $B$  provided the loss exceeds an amount  $B$ . The amount of the claim is

$$\min(X, A + B) - \min(X, B)$$

where  $X$  is the amount of the loss.

For fitting a loss distribution to the claim amounts, a number of adjustments to the data are needed:

- 'claims' need to be converted to 'losses',
- amounts need to be adjusted for inflation and other trends.

Once this is done, a loss distribution may be fitted—for example using the lognormal or Pareto distributions. The statistical techniques for this fitting procedure are beyond the scope of this paper, see Aitchison & Brown.<sup>(7)</sup> Various computer software packages which perform curve fitting are available on the market.

#### *Trends in Frequency and Severity*

It is important to distinguish between trends in frequency and trends in severity. These affect pricing in different ways.

Frequency trends (after eliminating the effect of trends on the exposure measure) can arise because of changes in legal or social conditions. Severity trends are influenced by changes in the legal and social environment as well as the economic environment.

'Social inflation' is the term that is usually used to describe the increase of the level of court awards, which has been somewhat higher than any of the standard measures of economic inflation in recent years. There may be a connection between the two. For instance social inflation may be due in part to 'catching up' with previously high economic inflation and partly due to expectations of future economic inflation.

Frequency and severity trends are interconnected. Changes in severity will be influenced by changes in the type of claim, and are therefore related to frequency trends. Changes in severity will themselves influence claim frequency. If the perceived 'payoff' is better, more people will pursue claims.

It is not easy to explain or predict the trends in claim frequency and severity. This is an area where the actuary will need to apply judgement.

#### *Contingency Loading and Simulation*

Because of the low frequency of claims and the high variability of claim costs, professional indemnity premiums require a significant loading for adverse contingencies to protect the solvency of the insurer. Risk theory says what the

appropriate loading is for given values of the various parameters involved—including the free capital available and the desired probability of ruin (see Beard et al<sup>(6)</sup>). This loading is based on one of a number of approximations that can be used.

The advantage of this way of loading is that it can be calculated directly. The disadvantage is that it gives little insight into the underlying claim process, and only takes reinsurance into account in a limited way.

An alternative is to carry out a simulation process. A large number of simulations are performed on a computer, where the claims are pseudo-randomly chosen from specified probability distributions. For example, the claims count could be modelled by a Poisson process and the claim severity could be modelled by the lognormal or the Pareto distribution.

This technique can more easily take reinsurance arrangements and aggregate deductibles into account. It also de-mystifies the process, which may be an important consideration when the actuary has to present the results to managers and underwriters.

However, the disadvantage of simulation is that it is more time consuming than the direct method. In situations where there is plenty of data, the direct method would probably be used.

#### *Ratemaking for Excess of Loss*

The discussions so far have concentrated on estimating rates for coverage based on losses from the ground up (FGU). In practice, there will only be a layer of losses that are covered. A claim will arise only if the loss extends into that layer. The amount of the claim will be the total amount of the loss, subject to a maximum of the upper limit of the layer, less the lower limit of the layer.

FGU rates, which can be calculated as loss frequency multiplied by mean loss amount, are also known as 'total limits' rates. In the absence of aggregate deductibles or aggregate limits, other rates can be derived from the total limit rates by what are known as 'increased limits factors' or ILFs. These ILFs represent the ratio of loss costs in a given layer to total loss costs, and are based on the assumed statistical distribution of losses. The ILFs are affected by inflation and therefore must be reviewed periodically.

The ILFs can be applied directly to obtain excess of loss rates for facultative covers. For excess of loss reinsurance, which may cover a wide variety of risk, a rate is charged as a percentage of the original premium. This rate is essentially an average ILF with adjustments if necessary to allow for the adequacy of the original premiums.

The above comments apply to the situation where there is no aggregate deductible or aggregate limit. To deal with these added complications, a two-way table of ILFs is needed. Moreover the ILFs then become a function of the loss frequency as well as of the severity distribution.

Here ILFs have been calculated relative to the *total* loss and applied to the *total limits* rates. The more common practice is to calculate such factors relative to the *basic* loss and apply them to *basic limits* rates.

### *The Office Premium*

Going from the risk premium, including the safety loading, to the office premium involves adjustments for expenses, investment earnings and profits.

No special problems arise for professional indemnity insurance in the case of expense loadings. As usual, the incidence of acquisition expenses, general administration expenses, and claims handling expenses are different and therefore should be loaded into the premiums in a different way.

Although predominantly on a claims made basis, professional indemnity claims have a fairly long payment tail. There is therefore scope of investment earnings. The potential investment earnings will depend on the particular profession and territory as these have a major influence on the likely payout pattern.

If the potential investment earnings are not to be taken as an additional safety margin, one way of allowing for them is to increase the target loss ratio by a factor calculated as the ratio of the undiscounted claims and claims handling expenses to be discounted claims and claims handling expenses.

To calculate the discounted values, one needs assumed payout patterns and rates of interest. Because of the uncertainties involved, the discounting should be somewhat conservative. This means that the payout patterns should be fast and the interest rates low. The incidence of claims handling expenses will be different from that of the claims payments. A significant part of the claims handling expenses is incurred when the claim is first reported, for example. Therefore different payout patterns may be used.

## 4. CLAIM RESERVING

### *General Principles*

We will not give a detailed discussion of the principles of claim reserving. However, it is helpful to state why claim reserving is necessary.

Reserving is the process of setting a value on the liabilities accrued at a particular time. For an insurance company, it is necessary in order to ensure a high probability that the obligations to policy holders can be met. For a self-insurance organization, it is desirable in order to fulfil the objectives of advance funding of losses. 'Post-loss funding', which is essentially a pay-as-you-go basis, is also possible but perhaps not as satisfactory.

The actuary who carries out claim reserving is inevitably involved in financial reporting of some kind. This is covered by the Institute guidance note, GN12<sup>(2)</sup>. GN12 sets out, among other things, the main considerations which the actuary should have when reporting on claim reserves, unless there are overriding reasons otherwise.

Some of the more important considerations are:

- (i) taking account of the types of business written, including the protection by reinsurance,

- (ii) the effect of the administrative systems on the statistical development,
- (iii) the effect of accounting framework on the interpretation of results, and
- (iv) the restrictions imposed by the form of the available data.

Changes in any or all of these should be particularly noted and taken into account.

### *Special Features of Professional Indemnity Business*

We will assume that the professional indemnity business is separately identified and forms a significant part of the total business, and so is being reserved for specifically.

Professional indemnity business is a form of liability insurance and therefore has a much longer period of development than classes involving purely physical damage. It differs from many other liability classes in being predominantly on a claims made basis rather than a losses occurring basis, at least for U.K. business.

It is possible that old business was written on a losses occurring basis. This should be established, otherwise the blind use of a statistical method such as the chain ladder method would apply a longer tail than is appropriate to the more recent years written on a claims made basis. The development on a claims made basis is not always as short as might be thought. Although claims should be notified to the primary insurer within a short time of the end of the period of cover, it is unlikely that a significant payment would be made so quickly. The insurer may not even set up large case reserves, possibly because of a large aggregate deductible.

Where a reserve has been set up for an individual claim, the reserve may take into account the likelihood that the claim will be settled for less than the full amount of the claim. Or the amount may simply be inadequately estimated, especially if little information is available to the insurer. This may sometimes happen in mutuals where the professionals themselves, who are not insurance specialists, are responsible for estimating the reserve. In addition, case reserving procedures may have changed significantly over a period of time.

Reserving therefore involves estimating the IBNER reserve (Incurred But Not Enough Reported) as well as the IBNYR reserve (Incurred But Not Yet Reported). Indeed, for claims made cover the IBNER should be many times more significant than the IBNYR. There will still be some IBNYR unless the evaluation date is after the end of all reporting periods for all policies covered by the reserve review.

Where the insured was previously covered on an occurrence basis but has now changed to claims made, the retroactive date for the claims made policies will usually be fixed so that the insured is not covered twice for the same period of exposure. This means that the exposure of claims made policies increases over a period of time until they reach maturity point. That is, if the insured switched from occurrence to claims made in 1980, then 1980 policies would be exposed for one year (1980), 1981 for two years (1980 and 1981) and so on. This should be borne in mind as it can significantly distort the statistics.

The information available to a reinsurer is much more limited than that available to the primary insurer. For instance, a reinsurer may well not have any information at all on the numbers of claims. Where the information is available it may not be meaningful. For example, a claim could mean different things to different people. Where the reinsurer writes on an excess of loss basis, notifications from the reinsured may only arise when the primary insurer expects to make a claim from the reinsurer.

### *Data Requirements*

Ideally, the actuary should attempt to obtain as much relevant information as possible. This includes historical data on claim numbers and claim amounts (both paid and incurred, which includes case estimates of outstandings) both before and after reinsurance. If possible the claim statistics should be classified by report year and accident year. Premium statistics will also be required, so that the exposure can be allowed for and also so that any further expected premium development can be calculated. When the excess of loss reinsurance arrangements have changed it can be misleading to work with net statistics. In this case it may be necessary to obtain information on the distribution of claims by size in order to estimate the recoveries expected.

The actuary should also try to find out as much background information as possible about the nature of the business written and how it has varied over time. This background information includes policy conditions, especially limits and deductibles. Changes in underwriters, management, or even ownership of the company can often mean a change in the business written. Significant changes in premium volume should alert the actuary, although these could be due simply to rate-level changes.

Given the significance of IBNER compared with IBNYR, the policy on estimation of known claims is especially important, particularly when claims managers have changed during the period being considered. However, it is very unlikely that a reinsurer will be aware of detailed changes in the reserving policy of its reinsureds. Also, the administrative systems and their capabilities and failing should be investigated, if possible, as this may influence the quality of the data available and the analysis techniques which will be appropriate.

If the actuary were to subclassify the data according to every major item that is likely to influence the claim development, then the resulting subgroups would be incredible (in the statistical sense). It is very likely that any meaningful pattern would emerge in each group given the rather low frequency of professional indemnity claims. However, provided the mix has not changed too much or too quickly, larger groupings can provide more reliable development statistics. Of course, this is a matter of judgement which can only be obtained through experience.

### *Inadequate Data*

Because of the various influences peculiar to each insurer, the insurer's own

business should be analysed if at all possible. Even so, no definite pattern may be apparent and, certainly where the company's own history is limited, some judgement will have to be made about the future development of some years of account.

Unfortunately, there is not published information in the U.K. on professional indemnity business which can help to set an external standard or benchmark for loss reserving. In the U.S.A. there is a certain amount of published information, but it is unlikely to be suitable for purely U.K. business because of the differences between the two legal systems.

However, from time to time insurers, intermediaries, and associations commission reports from independent actuaries on individual large risks and these are sometimes available within a coinsurance pool of companies or Lloyd's syndicates. If the actuary has access to these reports they can be a valuable source of information. However, such reports are often specific to a particular situation and the decision as to how appropriate they are in a different context must be a matter of judgement for the actuary concerned.

Another source of information is the statistics compiled by the brokers for the various risks. These can be good but do not usually include any background information on the types of business written.

#### *The Bornhuetter-Ferguson Method*

We do not intend to recommend any one particular reserving method in this paper. Nevertheless, we wish to discuss the method which was introduced in the paper by Bornhuetter and Ferguson.<sup>(3)</sup> The method is widely used in the U.S.A., but has not received much attention in the U.K. actuarial literature. The method is mentioned in Craighead's paper,<sup>(4)</sup> but is not fully explored there.

The long tail nature of professional indemnity business means that a statistical method, based on historical development over a long period, is likely to be most valuable. However, the chain ladder method is not always entirely appropriate for projecting the most recent years. Because of the comparatively low amounts of claims reported at early durations, there are relatively large random deviations in the reported data and, consequently, in the development factors. Moreover, large aggregate deductibles which are common in professional indemnity business mean that the early years of development may have no paid claims, or even no notified incurred claims. Clearly, the chain ladder method gives ridiculous answers in this case.

It is helpful to consider two extreme situations. After a block of business has been written, but before any claims are notified, the best estimate of the ultimate claim amount is arguably the written or earned premium multiplied by an assumed claim ratio. This method gives 100% weight to the exposure and no weight to claims because there are none. When the run-off of claims is complete, the ultimate claim amount is known completely, irrespective of the premium volume. Thus we can give 100% weight to the claims and no weight to the exposure. At intermediate valuations it is therefore reasonable to give  $x\%$  weight

to the exposure and  $100 - x\%$  weight to the claims in determining the estimated ultimate losses.

There are three components necessary in order to apply this approach:

- (i) An exposure based method.
- (ii) A claims based method.
- (iii) A set of weights.

In the Bornhuetter–Ferguson method, which uses the ideas above, (i) is taken as the expected claim ratio method described above, (ii) is taken as the chain ladder method and (iii) is taken as the expected percentage of claims paid (or paid plus outstanding if we are working with incurred claims). In this method the assumed claim ratio must be selected by judgement, based on a knowledge of market conditions.

So, if the earned premiums are  $P$ , the expected claim ratio is  $L$ , the exposure based method gives ultimate claims of  $P \times L$ . If the reported paid or incurred claims are  $R$ , and the chain ladder method gives ultimate claims of  $C$ , the expected percentage of claims paid or incurred is  $R/C$ . The Bornhuetter–Ferguson method then gives ultimate claims of:

$$C \times (R/C) + P \times L \times (1 - R/C)$$

This algebraic expression leads to an alternative formulation of the Bornhuetter–Ferguson method. The projected ultimate claims are equal to the sum of:

- (i) the actual paid claims (or paid plus outstanding claims), and
- (ii) the expected unpaid claims (or unreported claims).

The latter is equal to the expected unpaid percentage multiplied by the written or earned premiums multiplied by the assumed claim ratio.

As the experience matures, the expected claims are gradually replaced by actual claims. That is, (i) is increased by the actual payments and (ii) is reduced by the expected payments.

The Bornhuetter–Ferguson method is automatically immune from the fluctuations and distortions due to abnormally large claims which can be a problem with the ordinary chain ladder method. However, one major disadvantage of the Bornhuetter–Ferguson method is its dependence on an expected claim ratio, which must be selected by judgement.

We give some examples in Appendix 2.

## 5. ALTERNATIVES

### *Overview*

More and more professionals are looking for alternative means of managing their professional liability risks. Sometimes they consider that the traditional insurers are charging too much. In other cases they cannot buy cover at any price. Often a firm or group of firms in a profession which has some members who have

had large claims against them feel that they are being unjustly penalized by having to pay higher rates than are justified by their own experience and exposure.

Some professionals or professional firms are looking for alternatives by themselves, while others are joining other firms or groups. In some professions the professional bodies are taking the initiative.

Alternative means of insurance include self-insurance, forming a captive either with a group or other firms of professionals or individually, or forming a mutual insurance company with a group of others.

These options are not necessarily mutually exclusive, and many combinations of these and more traditional methods of cover are possible.

### *Self-Insurance*

This includes both 'going bare'—having no insurance at all—and taking a much higher deductible than previously. It may be combined with other methods by taking a high deductible and insuring the excess.

Self-insurance reduces the transfer of risk which takes place when insurance cover is purchased. It usually involves the exchange of a fixed cost for a variable cost, or an increase in the variability of a cost. Self-insurance generally has a lower expected cost than insurance (at least partly because of the insurer's profit margin) but has a higher maximum possible cost. This relationship may not hold in periods of overcapacity and stiff competition in the insurance market, but must be true in the long run.

The variability can be reduced by using an appropriate planned funding programme, as for a pension scheme, but this is not encouraged by the tax environment in the U.K. Another way of reducing the risk is to use excess of loss insurance. This is especially valuable as PI losses are potentially very large. However, even if excess of loss insurance is taken out, there is still the possibility of claims exceeding the maximum protection.

In the end, the decision whether to self-insure must be based on the firm's (or individual's) willingness to accept the risk of adverse results in comparison to expectations, financial ability to pay losses in excess of expected or insured levels, and the costs of insurance protection. Many firms are willing to pay a premium to 'sleep sound in their beds at night': they recognize that self-insurance or higher retentions would be cheaper but are unwilling to bear the risk.

It is a condition of membership of some professions to have PI insurance, presumably to protect the client and others who are relying on the professional, and self-insurance does not usually meet the requirement.

Self-insurance is thought by some to have a positive effect in decreasing the number of claims. The argument goes that a claimant is less likely to sue if there will not be enough money to pay the claim. If there is no insurance there is less money available and even a successful claim may never get paid. This argument is difficult to prove one way or the other, but is probably applied in practice by some small firms who may not have investigated the consequences of self-

insurance fully. Large firms who use self-insurance are more likely to be aware of the risks involved and in any case are more likely to be able to pay claims so the argument loses its validity.

The move towards a higher element of self-insurance in the form of higher deductibles has two main interconnected causes. Firstly, premiums are less for higher deductibles so that the insureds are forced to take higher deductibles as a matter of economics. Secondly, insurers feel that experience may be better if a higher deductible is taken, as the insured will have more interest in keeping claims down. Many professionals are being forced into taking higher deductibles rather than choosing to do so.

### *Mutuals and Captives*

Most PI mutuals in the U.K. are set up as companies limited by guarantee, owned by their policyholders. The alternative arrangement is as a captive company limited by shares. The reasons why mutuals have been more popular than captives are probably the relative simplicity of mutuals, their greater tolerance by insurance regulatory authorities, particularly regarding capitalization requirements, and the general philosophy which underlies the mutual concept as against that of a limited liability company.

The number of PI mutuals has increased rapidly in the past few years. Professions in which they have been formed, or may be under consideration, include Architects, Accountants, Solicitors and Lloyd's Brokers. Appendix 3 summarizes some of the information available about existing and potential mutuals.

Some of these, such as the mutual run by the Law Society for solicitors, are for an entire profession. Others, such as the Wren for architects have only a few firms as participants. However, they all have one basic principle in common. As participants in a mutual company, limited by guarantee rather than by incorporation, the members have unlimited liability for the debts of the mutual. This means that if there are enough large claims to exhaust the funds of the mutual all the members, regardless of their own claims experience, have to contribute by way of a call in order to pay the claims.

One effect of this unlimited liability is to make mutuals selective about whom they admit as members. This is comparatively easy for mutuals formed by small groups of firms, but there are problems for mutuals run by professional bodies, especially in those professions which make PI cover compulsory. In this case the mutual can get in the position of being effectively a licensing body for the profession, since if membership is refused the professional is unable to practice. This difficulty may be overcome by charging very high premiums where the situation warrants.

Unlimited liability also encourages many mutuals to have strong policies on risk control. Some make participation in regular audits of office routines and practices a condition of membership. Others produce bulletins of recommended practices.

This principle of unlimited liability is moderated by at least one mutual, which provides its members with the opportunity to buy stop-loss insurance limiting any calls which may be made to a proportion of the original premium.

Some mutuals have the reduction of claim costs as one of the reasons for their formation. One way of accomplishing this is to improve risk control procedures. Another way is to improve control of claims handling. Legal costs form a large proportion of many liability claims. By employing lawyers directly, rather than using external solicitors, managers of mutuals hope to reduce this cost significantly. This is especially true of those mutuals managed by firms who have traditionally managed shipowners protection and indemnity (P & I) clubs and are now moving into the PI field.

When a mutual is established, it is usual for the members to guarantee to participate for at least the first few years, often three. Thereafter it is usually only possible to leave by giving notice of doing so as required in the rules of the mutual. A common period of notice is two years. There are then rules which have to be followed in order to determine whether the leaving member is to be released from liability for further calls from the mutual. The combined effect of the rules could be that it takes up to ten years to disentangle entirely. Obviously, the exact period depends on the rules of the particular mutual and in many cases is much less than ten years.

To a certain extent there is a love/hate relationship between the traditional insurance market and the new mutuals. The mutuals are removing premium income from the market, but usually need reinsurance protection themselves. Underwriters in the market are trying to write risks which will make profits for their shareholders (or names in Lloyd's). Mutuals are trying to write risks at breakeven rates, so that if rates in the market are adequate the rates charged by a mutual are likely to be lower. However, some traditional writers see the mutuals as removing some of the worst risks from the market.

There are some large international mutuals, run by large international brokers, which operate somewhat differently to those described above. They have a system whereby the participants in the mutual buy shares in proportion to the amount of the premium they pay.

Although most mutuals formed in the U.K. have the reduction of insurance costs as one of their aims, they adopt widely differing policies on premium levels. Some, especially those who wish to recruit large numbers of members, start off by fixing rates at levels they believe are justified by their members' experience, often significantly below those offered in the market.

Others, with smaller groups of participants, aim to reduce rates gradually over a period, or at least increase them more slowly than market rates. These mutuals may start out by charging participants the same rates as they were paying before joining the mutual. They then monitor the experience, especially the effect of any loss control procedures or improvement in the claim handling process, and adjust rates accordingly.

As the whole phenomenon of PI mutuals is so recent in the U.K., it is not possible to tell at this stage how these strategies will work out in practice.

### *Risk Management*

There are three aspects to risk management. The first is Risk Financing: how much risk should a single professional or firm bear, what types of insurance are suitable, what compromise to accept between cover and cost. This aspect has been discussed briefly in the Section on *Self-insurance*. The second can be termed Risk Control: trying to control the likelihood of a claim arising. The two cannot be separated entirely, as risk control has to be paid for but may reduce the cost of insurance cover or in some cases the need for cover. Thirdly, there is Loss Control: trying to control the size of claims once they have arisen.

If either self-insurance or a mutual company is used, risk control becomes a very important issue. If a firm of professionals decides to self-insure, the value of a high-quality of risk control is obvious. The fewer claims arising, and the less severe they are, the less the cost of self-insurance. Groups of firms forming a mutual are in a similar position, except that they also have an interest in each other's standards.

There are many different attitudes taken to risk control by professionals, ranging from "of course we're all professionals here so what's the problem?" to formal systems of office practice designed to reduce exposure to PI claims. Most professionals would agree that prevention is better than cure, and that it is better to avoid any claims being made to fight them successfully. The time and effort involved in contesting a claim often involves diverting otherwise productive resources from the main business of the professional.

The first step in most professions is to follow the code of conduct put out by the professional body. These vary greatly in length and comprehensiveness—the Law Society's 'A guide to the professional conduct of solicitors' is a book running to 229 pages including an index of 17 pages and a list of references 7 pages long. Most, including our own, are shorter.

Although following the professional code of conduct is important, it may not always provide detailed guidance on all aspects of the professionals work. Many such codes deliberately stress general standards rather than detailed procedures. Many firms have checklists to follow when performing an assignment for a client, to ensure that no important stage of the process is omitted. Obviously, the details and indeed the extent to which this is possible vary from profession to profession and even by type of work within a profession. There are also procedures to check that not only is no stage omitted, but also that the work done has been carried out to a high standard of quality. This stage may involve formalized checking and review processes.

To some extent, having professional standards may increase the likelihood of a claim being successful. A claimant has a better chance of showing that an individual failed to meet the standards of the profession if those standards are clearly set out than if they are not.

Where a group of firms have formed a mutual and are trying to implement some form of risk control, there may be unforeseen difficulties. Firms do not wish their fellow participants, who are also their commercial rivals, to learn the details of their practice. They may agree to have their professional practices reviewed

only with the strictest safeguards in respect of confidentiality. However, if the information so gained is to be used for underwriting purposes problems may well arise.

## 6. THE FUTURE

### *Mutuals and Captives*

In our view, the most significant development in the area of PI insurance in recent years has been the growth of mutuals and captives. Will this growth continue, and will those which have been established be successful?

As all actuaries know, crystal ball gazing is a difficult exercise at the best of times. We usually try to use past experience as a guide to the future, but the past experience of PI mutuals in this country is limited, with the obvious exception of the medical defence organizations. However, these organizations are different in many important respects from the new breed of mutuals, and may not be a good guide.

A better guide may be provided by the experience in other countries, most notably in the U.S.A., where professional indemnity mutuals have been around for rather longer than over here. Of course, the environment in which they operate is different, but some useful parallels may be drawn.

It seems intuitively obvious that the mutuals will only be successful if they are prepared to charge adequate premiums. If capacity rises in the market, rates fall, and cash-flow underwriting appears again, some mutuals may find it difficult to increase premium rates or even to keep them stable. However, if they are operating risk control procedures and strict underwriting standards on admission their rates may be able to be both competitive and adequate. The market pressures on mutuals are lessened, but not completely eliminated, by the fact that participants often have to give long periods of notice before withdrawing.

It has been the experience in the U.S.A. that the mutuals are often unwilling to raise rates by the amount recommended by their advisers.

The final say in the matter often rests with the board, composed of professionals who are usually laymen in insurance terms and who may be under considerable pressure from their peers to keep rates down. As a result, some of these mutuals are now financially less than healthy. This has not stopped new mutuals being formed in the U.S.A.

We hope that some of the lessons of the U.S.A. experience will be learnt, and that the mutuals in the U.K. will have a more robust attitude to premium rates. We fear that this may not be the case. However, there are some encouraging signs that a number of the mutuals being formed which are not only expected to provide lower premiums by their participants, but are also being used as a way of improving quality control and the costs of claims handling.

We expect the formation of mutuals in this country to continue, although the rate of growth may slacken off if PI cover becomes easier to buy in the commercial market. If an existing mutual has severe financial difficulties,

prospective participants may become worried about the security of the cover provided by mutuals, with a predictable effect on the formation of new mutuals.

It seems likely that some of the really big risks will never be covered again by the commercial market. Many in that market view the prospect with a sigh of relief.

### *The Actuarial Profession*

If, as we expect, the formation of PI mutuals in the U.K. continues, this will present a challenge to the actuarial profession. The financial management of a PI mutual is something which actuaries appear well equipped to deal with. Apart from the aspects of professional indemnity insurance which we have covered in this paper, there is the question of asset management, reinsurance requirements and capital needs.

If actuaries do become involved in providing advice to existing and potential PI mutuals, there will be implications for their own professional liability risk. It is an area where actuaries do not have a long tradition of experience on which to draw, and they will be working with the very people who have professional negligence uppermost in their minds.

This leads to the final question we wish to consider. If other professions are considering the formation of PI mutuals, should the actuarial profession do the same? On one hand, actuaries, by their training in and experience with establishing certainty out of uncertainty, should be well equipped to manage such a mutual. On the other hand, the actuarial profession is relatively small and somewhat fragmented in nature. We hope this will be an interesting question to pose, but we do not intend to suggest an answer of our own.

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APPENDIX 1

CLAIMS MADE vs OCCURRENCE

It is often stated, as a well known fact, that ‘claims made premiums are always less than occurrence premiums’. However, it seems intuitively obvious that the total cost of the two forms of cover must be the same if they are covering the same risks and the time value of money is ignored. So, what is going on?

The answer is that the above sweeping generalization is true in most cases on a year by year basis. However, like is not being compared with like as the cost of tail cover is not being included in the comparison. In this Appendix we develop a simplified mathematical model and explore the relationships between claims made and occurrence premiums.

Let  $C_i$  be claims arising from incidents occurring in year  $i$  (the accident year), and let  $P_j$  be the proportion reported in year  $i + j$ , assumed independent of  $i$ ,

so 
$$\sum_j P_j = 1, \quad \text{and} \quad P_j \geq 0 \quad \text{for all } j.$$

The claims reported in each calendar year are as in the following table:

<i>Arising from incidents in</i> Year	<i>Calendar Year</i>								
	1	2	3	...	$k$	...	$N$	$N+1$	...
1	$C_1P_0$	$C_1P_1$	$C_1P_2$	...	$C_1P_{k-1}$	...	$C_1P_{N-1}$	$C_1P_N$	...
2		$C_2P_0$	$C_2P_1$	...	$C_2P_{k-2}$	...	$C_2P_{N-2}$	$C_2P_{N-1}$	...
3			$C_3P_0$	...	$C_3P_{k-3}$	...	$C_3P_{N-3}$	$C_3P_{N-2}$	...
...				...		...			...
$k$					$C_kP_0$	...	$C_kP_{N-k}$	$C_kP_{N-k+1}$	...
...						...			...
$N$							$C_NP_0$	$C_NP_1$	...

The risk premiums payable on an occurrence basis are found by summing across the rows, so the premium for year  $k$  is

$$\sum_j C_kP_j = C_k \sum_j P_j = C_k, \quad \text{as expected.}$$

The claims made premiums are found by summing down the columns, so the premium for year  $k$  is

$$\sum_{i=1}^k C_iP_{k-i}$$

The total occurrence premium paid for years 1 to  $N$  is

$$\sum_{k=1}^N C_k$$

The total claims made premium paid for years 1 to  $N$  is

$$\sum_{k=1}^N \sum_{i=1}^k C_i P_{k-i}$$

Which is the same as

$$\sum_{k=1}^N C_k \sum_{j=0}^{N-k} P_j$$

To provide the same total cover as the occurrence basis, tail cover from the end of year  $N$  must be included. This amounts to

$$\sum_{k=1}^N C_k \sum_{j=N-k+1}^{\infty} P_j$$

So we see that the total premium paid is

$$\sum_{k=1}^N C_k, \quad \text{as expected.}$$

Now, suppose that the reporting pattern is limited: that is, there is an  $r$  such that

$$\sum_{j=0}^r P_j = 1, \quad P_j = 0 \quad \text{for} \quad j > r.$$

Then, for  $k > r$  we have the claims made premium in year  $k$  is

$$\sum_{i=k-r}^k C_i P_{k-i}$$

If we assume that the risk is constant by year, so that  $C_i = C$  for all  $i$ , we have

$$\sum_{i=k-r}^k C_i P_{k-i} = C \sum_{i=k-r}^k P_{k-i} = C \sum_{j=0}^r P_j = C, \quad \text{putting } j = k-i.$$

So that in the ‘steady state’, the claims made and occurrence premiums are equal.

However, the claims made premiums are less than the occurrence premiums in the early years, and tail cover is required at the end to provide the same overall cover.

Let us now assume that instead of constant risk  $C$  we have a constant trend, so that  $C_i = (1 + g) C_{i-1}$ . In effect, assume that inflation applies to the accident year.

Then we have the occurrence premium for year  $k$ ,

$$C_k = (1 + g)^{k-1} C_1.$$

For  $k > r$  as before, the claims made premium is

$$\begin{aligned} \sum_{i=k-r}^k C_i P_{k-i} &= \sum_{i=k-r}^k (1+g)^{i-1} C_1 P_{k-i} \\ &= C_1 \sum_{j=0}^r (1+g)^{k-1-j} P_j, \quad \text{putting } j = k-i, \quad \text{as before} \\ &= C_1 (1+g)^{k-1} \sum_{j=0}^r \frac{P_j}{(1+g)^j} \end{aligned}$$

Now,

$$\sum_{j=0}^r \frac{P_j}{(1+g)^j}$$

does not depend on  $k$  and, if  $g$  is positive, is always less than unity.

This means that with this steady inflation, the steady state claims made premium is less than the occurrence premium payable for that year, and the two are directly proportional.

A more realistic model for inflation would not apply to the year of occurrence, but rather to the year of reporting or even payment. If we now define  $C_i, P_i$  to be at year 1 monetary values, then the occurrence premium in year  $k$  is

$$\begin{aligned} &C_k(1+g)^{k-1} P_0 + C_k(1+g)^k P_1 + C_k(1+g)^{k+1} P_2 + \dots \\ &= C_k(1+g)^{k-1} \sum_{j=0}^r (1+g)^j P_j \end{aligned}$$

with  $r$  as before.

The claims made premium for year  $k (> r)$  is likewise

$$(1+g)^{k-1} \sum_{i=k-r}^k C_i P_{k-i}$$

If we assume constant real risk, so  $C_i = C$  for all  $i$ , the occurrence premium of

$$C(1+g)^{k-1} \sum_{j=0}^r (1+g)^j P_j$$

compares with the claims made premium of

$$C(1+g)^{k-1} \sum_{i=k-r}^k P_{k-i} = C(1+g)^{k-1} \sum_{j=0}^r P_j$$

So again, if  $g$  is positive, the steady state claims made premium is less than the steady state occurrence premium.

The model we are considering here is limited in three main respects.

Firstly, we have considered only constant trend rates. Trend rates varying by year will not alter the overall conclusion, which is that with positive trend the steady state claims made rate is less than the occurrence rate. Variable trend would, however, remove some of the simplicity from the relationship between the two rates.

Secondly, the model does not consider the payment pattern. Applying the trend to the date of payment would be more true to real life, but produces a model more complicated than we wish to discuss here.

The same can be said of the third limitation, which is that we have not considered the time value of money. This is probably the most significant of the three. In general, if the trend rate is greater than the discount rate, the claims made premiums will still be lower.

## APPENDIX 2

### AN EXAMPLE OF THE BORNHUETTER-FERGUSON METHOD

In this appendix we give an illustration of how the Bornhuetter-Ferguson method might be used in practice. The actual figures are entirely hypothetical, but are meant to represent an insurer's professional indemnity portfolio. For instance, this might be a quota share of a set of risks written by an underwriting agency at a moderate level of excess of loss on a facultative basis. In practice this background information is extremely important.

Table A2.1 shows the claims incurred statistics for underwriting years 1 to 9. We have truncated the development triangle at 5 years for this illustration.

The usual calculations are shown, with the report-to-report (RTR) factors and the report-to-ultimate (RTU) factors. To obtain the RTU factors we have used an assumed tail factor at 5 years of 1.500, which is equivalent to assuming that at that stage 66.7% of the ultimate claim amounts are expected to have been reported as incurred. This tail factor is a judgemental parameter which may be based on the actuary's experience of similar risks or based on the fitting of decay curves (see Sherman).<sup>(9)</sup>

Table A2.2 shows the preliminary calculations. Tables A2.3 and A2.4 show the results of using both the chain ladder method and the Bornhuetter-Ferguson method at the end of Year 9 and at the end of Year 8. Comparing the results at these two evaluation points shows the relative stability of the Bornhuetter-Ferguson projections compared with the chain ladder projections.

The expected claim ratios that we have used in our illustration of the Bornhuetter-Ferguson method are somewhat arbitrary. In practice, they would be based on the actuary's knowledge of the market including rate level changes compared with trends in claim frequency and severity. A cyclical pattern is fairly common in practice.

The table below shows the projected ultimate claim ratios at the two evaluation points and the change in the estimates of ultimate claims.

Table A2.1. *Projected Ultimate Claim Ratios and Change in Estimates (£)*

Underwriting Year	Chain Ladder			Bornhuetter-Ferguson		
	Year 8	Year 9	Change	Year 8	Year 9	Change
5	4.45	5.01	44,842	3.37	4.01	50,697
6	3.56	3.77	14,860	2.93	3.17	16,361
7	3.72	1.94	(86,260)	2.34	1.97	(17,533)
8	0.27	1.64	170,723	1.49	1.53	4,553

Table A2.2. *Derivation of Claim Development Assumptions*

Incurred Claims (£) Year of Underwriting	Year of Development				
	1	2	3	4	5
1	680	12,540	20,340	28,250	28,820
2	0	4,670	21,320	33,140	47,010
3	430	4,070	13,480	18,830	19,470
4	0	62,420	135,460	136,450	162,350
5	3,380	90,070	114,450	199,360	267,000
6	1,570	19,840	101,160	137,940	
7	1,270	35,280	36,360		
8	210	40,920			
9	160				
<i>Column Totals</i>	7,700	269,810	442,570	553,970	524,650
<i>Excluding last diagonal</i>	7,540	228,890	406,210	416,030	257,650
<i>Excluding last 2 diagonals</i>	7,330	193,610	305,050	216,670	95,300
<i>End of Year 9 Calculations</i>					
<i>RTR Factors</i>		35.784	1.934	1.364	1.261
<i>RTU Factors</i>	178.553	4.990	2.580	1.892	1.500
<i>% of Ultimate</i>	0.6	20.0	38.8	52.9	66.7
<i>End of Year 8 Calculations</i>					
<i>RTR Factors</i>		31.226	2.098	1.364	1.189
<i>RTU Factors</i>	159.371	5.104	2.433	1.784	1.500
<i>% of Ultimate</i>	0.6	19.6	41.1	56.1	66.7

Table A2.3. Results of Chain Ladder Method

*End of Year 9*

<i>Underwriting Year</i>	<i>Incurred Claims</i>	<i>Factor to Ultimate</i>	<i>Estimated Ultimate</i>	<i>Estimated IBNR</i>
(1)	(2)	(3)	(4)	(5)
5	267,000	1.500	400,500	133,500
6	137,940	1.892	260,982	123,042
7	36,360	2.580	93,809	57,449
8	40,920	4.990	204,191	163,271
9	160	178.553	28,568	28,408
	<u>482,380</u>		<u>988,050</u>	<u>505,670</u>

*End of Year 8*

<i>Underwriting Year</i>	<i>Incurred Claims</i>	<i>Factor to Ultimate</i>	<i>Estimated Ultimate</i>	<i>Estimated IBNR</i>
(1)	(2)	(3)	(4)	(5)
5	199,360	1.784	355,658	156,298
6	101,160	2.433	246,122	144,962
7	35,280	5.104	180,069	144,789
8	210	159.371	33,468	33,258
	<u>336,010</u>		<u>815,317</u>	<u>479,307</u>

Note: (4) = (2) × (3).  
(5) = (4) - (2).

Table A2.4. Results of Bornhuetter-Ferguson Method

*End of Year 9*

<i>Underwriting Year</i>	<i>Written Premiums</i>	<i>Expected Claim Ratio</i>	<i>Percentage of Ultimate</i>	<i>Estimated IBNR</i>	<i>Estimated Ultimate</i>
(1)	(6)	(7)	(8)	(9)	(10)
5	79,920	2.0	66.7	53,227	320,227
6	69,220	2.5	52.9	81,507	219,447
7	48,470	2.0	38.8	59,327	95,687
8	124,250	1.5	20.0	149,100	190,020
9	134,470	1.2	.6	160,396	160,556
	<u>456,330</u>			<u>503,557</u>	<u>985,937</u>

*End of Year 8*

<i>Underwriting Year</i>	<i>Written Premiums</i>	<i>Expected Claim Ratio</i>	<i>Percentage of Ultimate</i>	<i>Estimated IBNR</i>	<i>Estimated Ultimate</i>
(1)	(6)	(7)	(8)	(9)	(10)
5	79,920	2.0	56.1	70,170	269,530
6	69,220	2.5	41.1	101,926	203,086
7	48,470	2.0	19.6	77,940	113,220
8	124,250	1.5	.6	185,257	185,467
	<u>321,860</u>			<u>435,293</u>	<u>771,303</u>

Note: (9) = (6) × (7) × (1 - (8)/100).  
(10) = (2) + (9).

## APPENDIX 3

## A PARTIAL LIST OF MUTUALS

This Appendix contains a partial list of mutuals which are known to exist or to be under consideration, together with brief descriptions. The list is ordered by profession where possible. All the information in this list is from newspaper or magazine articles.

## 1. ACCOUNTANTS

*Mutual Accountants Professional Indemnity Co (MAPIC)*

This mutual is aimed at small to medium companies and had an initial target of 300 member firms by the end of its first year. The cover is limited to the U.K. and Europe and has a limit of £1,000,000 each claim. It claims to be the first mass market mutual.

*Charter Group*

This is a group of medium sized firms. At one stage they were considering a mutual but in February 1987 said they had got good terms without going down the mutual route.

*The Association of Practising Accountants*

This is a group of medium sized firms. There was a report in June 1987 that they were considering setting up an insurance mutual to reduce professional indemnity fees.

*XL Insurance Co (XL)*

XL started off as an industry captive writing excess liability insurance for a wide variety of large corporations. It operates from Bermuda but is registered in Barbados for tax reasons. It planned to write cover for accountants, lawyers and other professions when the plans for APEX (see below) collapsed after the U.S. Tax Reform Act was passed. However, the provision of cover to accountants was postponed. In March 1987 cover was being offered only to lawyers, trust departments of companies and other insurance companies.

*Associated Professions Excess Insurance Co (APEX)*

APEX was aimed at brokers, accountants and other professionals. This initiative fell foul of U.S. tax laws and never happened. Instead, XL now writes cover for professionals.

*Professional Asset Indemnity Ltd (PAIL)*

This now has all the Big Eight accountants as members. It offers cover in two layers, between \$50 million and \$100 million and over \$100 million.

## 2. ARCHITECTS AND SURVEYORS

### *The Wren Insurance Association*

The Wren was licensed by the DTI and started trading in early 1987. Twenty eight large commercial firms are expected to participate, with an aggregate fee income of £130 million per annum. Up to £5 million cover per claim can be offered.

### *Housing Associations Mutual Insurance Association (HAMIA)*

About 40 housing associations belong to this mutual which insures the associations' inhouse architects and surveyors. The architects and surveyors are required by the Housing Corporation to be treated at arms length on questions of liability and must have insurance to twice their fee income.

## 3. LLOYD'S BROKERS

There was a report in The Times in October 1986 that a group of Lloyd's brokers was considering setting up a scheme.

## 4. SOLICITORS

### *Law Society Mutual*

The cover provided is up to £500,000 each and every claim, which is the compulsory level of the Law Society. An annual premium of £52 million is expected.

### *Solicitors Indemnity Mutual Insurance Association (SIMIA)*

SIMIA provides cover of £4.5 million xs £.5 million on top of the Law Society's compulsory scheme. Over thirty five of the large London firms of solicitors are members.