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TECHNIQUES OF RESERVING—THE LONDON MARKET

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1. INTRODUCTION

THIS paper has been written to assist Actuaries making an acquaintance with the London reinsurance market and needing assistance with the practical difficulties involved when applying known reserving methods to that market. Examples are given throughout to illustrate every point made and to give emphasis to difficulties that arise in practice. To make the exercise fully realistic, all examples (except a few that are purely illustrative) are ones that have actually arisen in practice. The names of the relevant offices are not given and all cohorts of values have been multiplied by arbitrary constants which further conceal the identity without derogating from the value of the information that they contain. Graphs are used extensively.

The processes involve extrapolations of considerable degree and hence results are necessarily subject to a high degree of variance. Judgement is essential throughout and cases will arise where the Actuary simply has to say "no, this does not look correct. Let me try a different approach or probe further". In many cases it is useful to graph the results emerging from the method of extrapolation used so as to test it against actual figures so far as they have emerged.

2. GENERAL

2.1. When facing a problem in the estimation of reserves, particularly those embracing a considerable percentage of IBNR, there is no royal road to success. Various methods are available and all possible approaches must be examined. Much depends on the nature of the business and the way in which records are kept.

2.2. The London reinsurance market is a strange amalgam of direct business in areas which involve special features (not only marine, aviation and transport covers of many different types but also more unusual insurance such as satellite cover) with reinsurance business of all types (facultative, proportional and non-proportional treaties, covers and line slips) and the London market Excess of Loss reinsurance (which of all groups is the one most defying proper analysis).

2.3. No sharp or clear dividing line exists between the types of business written by direct-writing offices and the London market. Yet the distinction must be made for reserving methods to be successful. Examples are:

2.3.1. Direct Hull business, with Fleet owners involved in the background, possibly with liability cover and/or cargo carriage, is essentially London market business but the coverage of Yachts need not be. P and I Clubs are best treated as ordinary direct business.

2.3.2. Covers and Line Slips, particularly those with innumerable declarations to them, are similar in their practical working to Proportional Treaties of Reinsurance and are best handled in the same way. They can include direct insurance such as Cargo insured under Cover Notes by large insurers.

2.3.3. Aviation, even when written directly, is normally written by Fleets and may include both Hull and Liability coverage, perhaps also Cargo.

3. RECORDS AND STATISTICS

3.1. All effective reserving methods are an extrapolation of claims information in one form or another and depend on the analysis of the pattern of claim development by elapsed period from either the date of the claim (as in direct business) or the underwriting year of the Risk to which the claim relates (as in the London reinsurance market). Hence the way in which and the accuracy with which the figures are set out is crucial to the exercise.

3.2. In London market business the actuary starts with a 'triangulation' of premiums and claims or loss ratios by underwriting year and by development period. These are the basic tools. No 'number of claims' exists since it is not given in treaty returns to the market and is, in any case, a meaningless factor in excess of loss treaties.

3.3. All triangulation figures that can be of use take several years to develop. The actuary may well be in a position to advise on statistics to be produced in the future (see § 5.7 for suggestions in connexion therewith) but has to accept what is presented as a basis for calculation.

His concern will then be:

3.3.1. To what extent is the sub-division of classification meaningful in terms of claims development?

3.3.2. Can the figures be relied on? Are they accurate? Do they include any aberrations?

3.4. The approaches that will be available are:

3.4.1. An examination of the figures themselves. What do they 'tell' one? Do they look correct?

Bearing in mind that variations in London Market business results are often considerable, both in final results and in the build-up to those final results and that large fluctuations can occur along the way, are the figures 'normal'? Experience becomes invaluable at this point but common sense will help.

3.4.2. Detailed discussions with the technical managers of the office concerned, with a gentle probing of the methods used and of their understanding of the business, aimed both at finding out what basis underlies the statistics produced and the ability and accuracy of the technical staff.

3.4.3. Discussions with the underwriting staff, perhaps started only after some analysis of the figures has already been made so that apposite comments can be made and used as a basis for further probing.

3.5. It is truly amazing what is found in practice and what can emerge slowly from such discussions, both in regard to methods used and in regard to the accuracy of the data.

3.6. Lloyds data of 'closed' transactions (premium and claims) is reasonably accurate and is handled on a set basis through LPSO (Lloyd's Policy Signing Office) which covers all the accounting, acting as the channel between Brokers and Underwriting Syndicates, and uses a clearly defined basis as set out in its manuals. The Syndicates must follow suit and be up to date as to accounting for the monthly settlement to be checked by the Auditors as being correct and consistent with the statistics reported. Outstanding claim notifications are less carefully controlled but recording is normally reasonably good. There are some deficiencies in the system (see §4 below) but by and large the statistics are reliable.

3.7. It is in Reinsurance Companies and in Underwriting Agencies that strange approaches, as well as outright insufficiencies and inaccuracies, are mostly encountered and, unfortumately, with considerable frequency. Among items that have actually been encountered can be mentioned:

3.7.1. A number of large liability claims advised but not entered at all as liability is disputed, even though it is by no means certain that the defence will succeed and, in any case, compromises are highly likely to be made somewhere along the way.

3.7.2. Transactions arising in miscellaneous currencies not entered into the books at all until the settlement rate of exchange is known.

3.7.3. Rate of exchange differences arising on settlement being carried straight to an 'exchange difference' account in the profit and loss account instead of being recycled to the statistics to correct the premium and claim figures (still found in a majority of cases, although decreasing with the proper use of statistics). The correct handling of exchange differences arising on the settlement of treaty balance is hardly ever found.

3.7.4. Aggregate figures in sterling (or perhaps dollars) being presented solely in development triangulation form, even though accounts are maintained separately in U.S. $, Canadian $, U.K. £ and convertible sterling, with separate investments in each, the U.S. $ and Canadian $ being converted to £ at the separate rates of exchange that happened to apply at each development period of the statistics recorded. This is an old legacy of manual systems and some managers will even argue strongly that it is theoretically correct.

Sometimes outstanding claim amounts are converted at rates of exchange different to those used for converting premiums and paid claims (e.g. premiums and claims converted at 'constant' rates by underwriting year but outstanding claims converted at 'current' rates).

3.7.5. Outstanding claim figures that go up and down at different points of time in the development pattern. The proper recording of outstanding claim notifications are often the first thing that falls into arrear when technical staff is under pressure. At some point in time in the past there has been a 'blitz' on the

work and figures are brought up to date. Then they gradually slip into arrear again . . . .

3.7.6. All work of entering transactions into the books of accounts in arrear, claims more in arrear than premiums and outstanding claim notifications worst of all. Sometimes Underwriters will hold on to transaction advices for months, intending to enter them on record cards they maintain, before handing them over to technical staff.

3.7.7. Straight inaccuracies. All too often in cases where results are disastrous because underwriting staff have been of insufficient calibre to choose business correctly, technical staff were also of low quality.

3.7.8. Development statistics with 'lumps' in them. This can be due to a number of causes:

(i) An error made, perhaps by inputting an incorrect currency code, resulting in an abnormally large amount which is subsequently spotted and corrected through the computer by reversal and re-input but in a subsequent period (probably over a quarter end). The development figure is then incorrect at that quarter end.

(ii) Reinsurances put through at a period later than the incoming transactions to which they relate.

An account with a large proportion of its business ceded under various reinsurance arrangements (some facultative, some fac-oblig. treaties, some excess loss protections) should show relatively 'smoothed' results but is more likely to be very 'lumpy', usually due to reinsurance claim recoveries being entered in a different quarter from the incoming business to which they relate.

(iii) Large claims being advised at an early period in the development of an account before there is a substantial premium basis entered to support them (found particularly in Aviation business).

3.7.9. Letters of credit can lead to a number of problems:

(i) Either they may not have been included at all in the figures of outstanding claims or the entry may have been duplicated.

(ii) Drawings may not be included in claim payment amounts.

3.7.10. Loss reserves retained are included by some offices in claims paid; others are shown as part of the claims outstanding. They may have been overlooked altogether in the statistics.

3.7.11. The correct treatment of returns under proportional treaties can present several problems. The underwriting year to which both premiums and claims refer are not of particular importance to the cedant if it is a direct-writing office. Often the returns under a continuous treaty will be presented to the intervening Broker in bulk form only and the Broker is then left to do his best in sorting out the figures into their respective underwriting years.

Sometimes premiums reserves are released in the figures of a different underwriting year to that in which they were originally retained.

Portfolio transfers may have been set into non-Marine treaties at the request of reinsuring offices in order to achieve a cut-off situation and may be set up by the Broker, rather than the Ceding office, naturally in a somewhat arbitrary fashion.

3.7.12. Very recently it has become common practice for cedants in South American countries to set up premium reserves on all business reinsured, even facultative business. Some Brokers' offices rely on computer systems which have not been set up so as to cater for reserves on other than proportional treaty business and hence the premiums are quoted net of retentions.

3.7.13. It is now common (1985) for U.S. Companies to include a provision for IBNR in their figures of outstanding losses and a Letter of Credit may even have been set up of an amount sufficient to include IBNR (although the tendency is now strongly resisted). In such cases either (preferably) the IBNR provision must be excluded from the figures of outstanding claims in the development statistics produced or, where that is not possible as the separate amounts of outstanding losses and IBNR are not stated, special allowance must be made in IBNR estimates. The point is of particular application in the case of Lloyd's as LUNCO marks the outstanding amount to the effect that it includes IBNR by a note in the narrative but does not separate it out.

3.7.14. At the current time (end 1985) recent events have resulted in a whole host of problems in respect of insurance and reinsurance companies becoming insolvent or simply ceasing trading. Where they have been either cedants or reinsurers, there may be direct losses of monies due, which amounts need to be quantified and may well include figures hidden in IBNR reserves.

Where the company is a cedant, there is very likely concurrently to be a massive problem of inefficient recording and this may well result in a reinsurer being faced with sudden large demands for huge claim recoveries at a very late stage, totally outside the normal pattern of advices.

4. THE LLOYD'S SYSTEM

4.1. The method of operation in Lloyd's has the effect of presenting accurate figures but some peculiarities are involved:

4.1.1. Late signings can place both premium and claim amounts into the wrong underwriting year. The effect is particularly noticeable in the Marine market where signings one and even two years late, or more, are commonplace.

4.1.2. Exchange differences arising from miscellaneous currencies are not always tracked through the system effectively. Brokers tend to advise bulk figures covering a number of Risks. Differences arising from the release of reserves are left to Syndicate accountants to track and are usually carried direct to the Profit and Loss account.

4.1.3. Unless the Syndicate makes special provision, the statistics used as a

basis for reserving follow the Lloyd's audit code split particularly as that split must be used in verifying minimum reserving requirements by Auditors. It has a number of weaknesses:

(i) The split by audit codes purports to give some degree of separation between property and liability damage but the 'all other' classification in the non-marine field is far too wide a classification.

(ii) There is no split by type of business:
Facultative or Direct
Proportional treaties
Excess Loss treaties
Covers, Binders and Line Slips
LMX business.

4.1.4. The current minimum basis of reserving depends, with some rather loosely-defined qualifications, on the application of a percentage of premiums in order to obtain the full reserve amount, both claims outstanding and IBNR, net of reinsurance recoveries. In many ways it represents an extension of the UPR concept in direct insurance. It starts from the assumption of a break-even position, and is modified over the years by a type of adaptive control in the light of results ultimately expected. It is based on Lloyd's market experience as a whole, rather than that of any one Syndicate. The resulting figures sometimes tend to be too low in the closed years and can be dangerously low in the case of very long tail business when the market is weak.

5. THE TASK

5.1. Whatever investigations are made into the basis and accuracy of the figures presented and whatever steps are taken to improve accuracy or effectiveness, eventually the actuary is faced with the necessity of using what statistics are available to hand. Part of the report may well be targeted at obtaining some improvement in the reporting basis. In some cases improvements may be made within a few months; in many cases it will take several years for those changes to result in useful improvements.

5.2. The actuarial report may well have to be qualified heavily in terms of the statistics on which it is based. But the report must still be made, usually with limited time available.

5.3. The whole area of reserving in the London Market is a minefield of potential pit-falls and is subject in large measure to the impact of unforeseen developments. That factor must be made quite clear in the report.

5.4. The figures presented will usually show premium development and claims paid and incurred, possibly as amounts, more usually as loss ratios where:

Incurred loss ratio at development period t (measured from the beginning of the underwriting year) is:

$$\frac{\text{Claims paid plus claims outstanding}}{\text{Premiums booked at that point in time}}$$

5.5. The figures may be presented at annual, half yearly or quarterly rests from inception. It is far better, for purposes of projection, if they are given at quarterly intervals. Half-yearly figures are still usable, annual figures far less so. Sometimes the figures will be given at quarterly rests up to the end of year 3, when the account is closed, and thereafter at annual rests. Sometimes premium movements after year 3 are included as part of the claims, which is less an aberration than might initially be felt as, in many cases, premiums advised after year 3 stem from profit commissions or adjustments due to changes in the burning cost ratio of a non-proportional treaty.

5.6. Figures split into too many cells of information produce ratios too erratic for trends to be traced effectively. Figures representing overall totals only are difficult to analyse effectively. On the whole, one is seeking for cells containing not less than 500 Risks each or say, £500,000 of premium income (less for facultative business, rather more for proportional treaties).

5.7. The ideal split, in order of importance, is:

Marine/Non-Marine/Aviation (the standard market grouping).
Short/Long tail (of which more anon).
Type of business, probably
  Facultative
  Excess Loss Treaties
  LMX business
  Proportional treaties, Covers and Line Slips.

5.8. The figures presented may well contain a split by more detailed class of business. If so, the cells will almost certainly be too small to provide any possibility of meaningful projection and recourse will have to be made to the whole account figures or to groups of class summaries specially compiled for the purpose.

5.9. Preferably, it may be possible to use the class grouping in order to obtain separate development figures of the long tail portion of the account, which figures can then be deducted from the whole account figures to leave a residual short tail development.

5.10 It is less usual for the account to be split by type of business. The differences thrown up in development figures by the type of business are discussed later. Differences do exist; hence a merging of figures into a whole account picture necessarily detracts from clarity in projection estimates.

5.11. It is usual for premium figures (that is 'booked' premiums) to be shown as part of the development picture, together with loss ratios both paid and incurred. Hence claim figures can be derived, if not actually provided separately, both paid and outstanding. There is then a choice:

5.11.1. Whether to project separately for premiums and claims, or to project on loss ratios.

5.11.2. Whether to project on paid claims or incurred claims.

5.12. All possible approaches should perhaps be tried. Much depends on the type of business being analysed. A few comments of note can be made:

5.12.1. Projections of claims figures alone often work well but premium figures are much more difficult to project, at least before the account is closed at the end of the third year.

5.12.2. The accounting of premiums and claims are often interrelated. Consider the method of reporting, for example, in the cases of

Proportional treaty quarterly returns.
Bordereau advices on open Covers.
Adjustments in premiums based on burning cost ratios.

5.12.3. Claims paid (or, more precisely, claims agreed) would appear to provide a much more stable base than incurred losses, the figures for which depend on the reporting of loss advices and hence of outstanding claim amounts, bearing in mind particularly all the uncertainties and delays and omissions and sheer errors contained in outstanding claims advices. On the other hand, in long tail business particularly, the claims settlement figures at an early stage (say right up to the end of 7 or 8 years) are so small a part of the ultimate total as to form no useful basis for purposes of projection.

Furthermore, non-stochastic factors are at work. Management policies may change as to the rapidity of claim settlement. One Court case may hold up a number of settlements and, when decided, release a series of payments. Legislative changes may affect the position.

5.13. In practice one finds that projections based on incurred losses give higher figures than those based on paid losses and provide reasonably stable results.

All the techniques that can be explored depend more on the consistency of development figures than on their accuracy at interim points. Loss advices are being received from a whole variety of types and locations of sources, each with its own degree of delay and inefficiency. Taken all in all, advices that are received late one year are likely to be equally late when received from the same source the next year.

At the worst, there is likely to be a measure of consistency in the delay or degree of unreliability in the figures available. The pattern of claim development can be expected to be roughly constant. In practice figures of incurred loss ratios do provide a reasonable platform on which to erect an edifice of extrapolations except in those cases where there is added inefficiency in the office itself which has provided the figures.

The figures used as outstanding claim amounts in individual cases require a measure of consistency in themselves but some assistance is derived from the market as a whole. It is normal for the defence solicitor/attorney to provide an estimate and that estimate is accepted as the amount advised to the market. The Leading Underwriter may take a hand and may well set a figure, from all the

papers before him, when no clear estimate has been provided. Some offices show their own (higher) estimates in individual cases.

All my experience has shown that projections based on claims incurred are more reliable that those based on claims settled but in some cases there are available only claims settlement figures for projection. In particular, it has been customary over the years for those Lloyd's Syndicates that write Marine business to pay no great attention to the recording of claim outstanding advices (though the picture is now changing). The result is that estimates of reserves are more difficult to make and may produce less satisfactory results, particularly in the case of relatively new Syndicates.

6. METHODS

6.1. The following different methods can be distinguished and are discussed in more detail below:

6.1.1. The basic chain ladder method, in its various forms.

6.1.2. De Vylder method of projection by least squares (which can be regarded as a more sophisticated application of the chain ladder method).

6.1.3. Empirical 'rule of thumb' methods, reinforced by adaptive control, used over the years by many Lloyd's Syndicates.

6.1.4. Bornhuetter & Ferguson method.

6.1.5. Craighead's modelling process using a negative exponential curve as the underlying model.

6.1.6. Benjamin and Eagles' development of minimum audit requirement for the reserves of Lloyd's Syndicates.

All of these methods depend on claim development figures and most can be applied to claims separately or to loss ratios, paid or outstanding, period by period or cumulative.

7. CHAIN LADDER METHOD

7.1. The standard chain ladder methods provide reasonably good forecasting results if used with care and discretion, particularly for shorter-tail accounts where the development of the claim or loss ratio figures is fairly regular from one period of development to the next. Normally such methods are more useful when applied to direct-writing accounts than to reinsurance business.

7.1.1. Case Study 1 (see pp. 420–422) shows the development and the analysis for a London P & I Club where a large volume of reasonably accurately kept statistics were available.

7.1.2. The analysis has been carried out separately by:

(i) paid claims at quarterly intervals;
(ii) incurred claims at annual intervals.

CASE STUDY 1

A P & I Club (Direct Marine Business).

Illustrating two ways of calculating chain ladder ratios.
(a) On paid claims $000 (cumulative figures).

Development period in years

Policy year	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1971	875	3,087	4,679	6,000	6,824	7,290	7,653	8,215	8,291	8,741	8,752	8,846	9,182	9,039	9,065
2	1,124	3,606	5,936	7,343	8,162	9,007	9,312	9,628	10,136	10,631	10,791	10,843	11,150	11,153	
3	1,646	5,735	8,828	10,745	12,177	13,279	14,717	15,240	15,691	16,077	16,366	16,557	16,850		
4	1,987	6,314	10,800	14,647	17,182	17,974	19,670	21,313	21,783	22,456	22,757	22,828			
5	1,400	5,136	8,584	11,264	13,247	14,800	15,948	16,804	17,592	18,189	18,722				
6	1,415	5,539	8,716	10,581	12,679	13,874	14,650	15,272	15,731	16,431					
7	2,285	6,139	9,589	12,540	14,956	16,607	18,139	18,680	19,263						
8	2,289	5,957	10,090	14,440	16,935	18,770	19,252	20,586							
9	1,789	6,626	12,996	16,573	19,044	20,856	22,285								
1980	2,464	9,727	13,945	18,274	21,700	25,345									
1	3,005	8,005	13,998	18,124	21,263										
2	2,903	7,589	13,055	16,848											
3	1,896	7,389	12,944												
4	3,041	10,095													
5	2,413														
Totals	28,119	90,944		140,531	164,169		119,341	125,738		76,094	77,388		20,332	20,192	
		80,849	134,178		142,906	157,802		105,152	108,487		58,666	59,074		9,039	9,065
			121,234	157,379		132,457	141,626		89,224	92,525		36,246	37,182		
Ratios	·3092	·6025	·7703	·8560	·9056	·9353	·9491	·9693	·9643	·9833	·9931	·9748	1·0069	·9971	
Ratios acc. backwards	·088	·285	·474	·615	·718	·793	·848	·893	·922	·956	·972	·979	1·004	·997	

Case Study 1 (*continued*)

(b) Projection based on incurred losses estimates.
Ratios of figures at various stages of development.

Policy year	1–2	2–3	3–4	4–5	5–6	6 7	7 8	8 9	9 10	10–11	11–12	12–13	13–14	14–15
1971	71·43	91·21	94·84	103·66	102·94	101·59	97·52	104·20	98·06	99·50	102·60	99·69	100·55	98·08
2	82·67	93·35	108·03	103·01	102·20	102·12	98·47	100·10	95·58	100·62	101·77	99·88	100·89	
3	108·44	94·56	103·61	99·65	103·38	98·24	100·86	101·38	98·33	99·88	99·34	100·28		
4	50·54	97·52	102·19	101·76	101·44	96·76	100·25	101·44	99·99	100·24	101·06			
5	57·13	97·69	101·74	100·88	96·51	102·14	100·65	100·57	99·97	99·77				
6	60·77	98·53	105·74	103·57	98·84	100·23	101·84	100·58	98·85					
7	50·96	100·71	106·66	99·50	102·32	100·80	99·29	100·61						
8	54·51	100·27	102·33	96·61	101·97	99·35	101·97							
9	59·61	97·48	101·05	101·52	102·08	104·37								
1980	61·68	95·93	102·82	96·86	106·07									
1	57·84	91·47	99·19	108·51										
2	64·29	97·53	106·51											
3	53·80	104·33												
4	58·91													
Last 5 years														
Mean Ratio	59·30	97·35	102·38	100·60	102·26	101·38	100·80	100·92	98·54	100·00	101·19	99·95	100·72	98·08
Cumulative	61·73	104·11	106·94	104·45	103·83	101·54	100·15	99·36	98·45	99·91	99·91	98·74	98·79	98·08
On last														
3 years	59·00	97·78	102·84	102·30	103·37	101·51	101·03	100·59	99·60	99·96	100·72	99·95	100·72	98·08
Cumulative	64·08	108·61	111·08	108·01	105·58	102·14	100·62	99·59	99·01	99·41	99·45	98·74	98·79	98·08

Case Study 1 (*continued*)

Assuming that the latest line of development indicates completion of figures for policy year 1971 (which is confirmed by the outstanding loss reserves being a small negative amount), we can now obtain the probable total losses for each policy year by dividing by the cumulative ratios at the same development point. This is done for both the last and second last figures and a weighted average is used.

	Projections on paid losses ($000)			Projections on incurred losses ($000)	
Policy year	On last year's figures	On previous year's figures	Weighted Mean	Using ratios of last 5 years	Using ratios of last 3 years
1971	9,065	9,065	9,065	8,957	8,957
2	11,187	11,106	11,160	11,418	11,418
3	16,783	16,912	16,826	17,164	17,164
4	23,318	23,413	23,350	23,853	23,853
5	19,261	19,026	19,183	19,346	19,436
6	17,187	17,062	17,145	17,708	17,797
7	20,893	20,918	20,901	21,170	21,050
8	23,053	22,703	22,936	23,945	23,890
9	26,279	26,300	26,286	25,996	25,874
1980	31,961	30,223	31,382	31,249	31,066
1	29,614	29,470	29,566	28,335	27,865
2	27,395	27,542	27,444	27,170	26,274
3	27,308	25,926	26,847	26,613	25,621
Total			282,091	282,924	280,265
1984	35,421	34,557	35,113	30,590	29,322
5	27,420		27,420	23,532	22,669

Comments:

(1) On incurred losses a close inspection of the ratios appears to indicate that there may have been some change recently. Hence averages of the last 5 years and 3 years have been used (overall averages were also tried).

(2) The two methods give reasonably close results.

(3) The figures for 1984 and 1985 are very tentative, particularly the latter. In the future, it will be necessary to attempt a somewhat more reliable projection for the latest years. To attain this position, figures of incurred losses will be reported in future at quarterly intervals with close attention being paid to the reasonableness of the estimates of outstanding losses recorded.

(4) There may be an argument for ratioing down the figures based on paid losses by 8,957/9,065. If so, the total to 1983 would be 27,873, which now looks a little low.

8. DE VYLDER'S LEAST SQUARE METHOD[1]

8.1. The approach is explained in 'Surveys of Actuarial Studies'.[1]

The method is designed to complete the triangle of non-cumulative values by taking all known values into account using the assumption that values in successive columns are proportional (as in the chain ladder method) and obtaining new values throughout such that the sum of the square differences is a minimum for known values.

To do so, the ratios P_j of successive columns j (year of development) are obtained roughly and the approximation homes in by successive re-iteration of the following equations:

$$\chi_i = \sum_j C_{ij} P_j \Big/ \sum_j P_j^2$$

and

$$P_j = \sum_i C_{ij} \chi_i \Big/ \sum_i \chi_i^2$$

Where χ_i is the total claims in the underwriting year and C_{ij} starts off as the known claim amounts for underwriting year i and year of development j, eventually becoming the smoothed values.

In practice some 5 or 6 re-iterations of the two equations in succession are sufficient for the homing-in process.

It is also necessary to require in the re-iteration that

$$\sum_j P_j = 1$$

but if the year of greatest development is judged still not to be complete then at the end a suitable adjustment must be made.

The method appears to work well on premiums entered per period or on settled losses in any one accounting period.

It follows, if incurred losses are being projected forwards, that the figures included for outstanding claim advices are the increases/decreases per accounting period.

It does not work on cumulative figures as there is then no way of ensuring that the sum of the development ratios is 1. Cumulative figures must first be reduced to receipts or payments per accounting period but that can be achieved by computer program.

8.2. The ratios input initially, as being approximately the development ratios to be developed by the program, must be roughly correct for the program to work properly. If they are substantially incorrect, the 'homing-in' process may not be effective.

8.3. The procedure adopted by the method is designed primarily to operate on annual figures. Since both premium and claim advices tend to fluctuate violently in the London Market, it is preferable (and now usual) to use quarterly figures.

The computer program can be adapted to use quarterly figures for de Vylder's method but the results are not necessarily improved thereby. It is worth while doing the whole exercise of applying the method by clerical means, at least for one cycle of the homing-in process, as an exercise. It shows that the ultimate losses produced for each year of account are heavily dependent on results in the first few quarters where the development ratios are usually high and very variable. This feature is indicated by the formula, where the ultimate losses for a given year of account are approximated by:

$$\Sigma \text{ (Losses in quarter } x \text{ ratio) divided by } \Sigma \text{ ratios squared}$$

Case Study 2 (see opposite page) shows the effect. Adding 3 years of account has the effect of changing the results considerably, even though the development figures themselves are not unduly rough for the London Market.

8.4. Both the chain ladder methods generally and De Vylder's method depend on the ratio of settlement at any one development period to that at the next being constant from one underwriting year to the next. Premiums rates may vary and profitability vary but the claim development pattern must be constant. That assumption is crucial. If there is any variation from year to year then the method breaks down. An inspection of the ratios should be sufficient to see whether the assumption holds. There can be a number of causes upsetting the pattern:

8.4.1. A reduction or speeding up in the speed of processing claims.

8.4.2. A change in underwriting policy, leading to an increase or reduction in the proportion of liability business written.

8.4.3. A change in the speed of the reporting process or of the administrative recording generally.

The second special feature mentioned above represents the cause of change most frequently found in the London Market. It can be allowed for by making a change in the ratios applied but the change itself must be largely arbitrary and the effect difficult to control adequately.

8.5. Generally speaking, reinsurance business and the London Market generally presents figures which are considerably too 'rough' and too much subject to change for the chain ladder method to be successful by itself and without the assistance of more powerful methods of projection.

8.6. Furthermore, one is frequently faced with the requirement of estimating eventual results when the office has been writing business for only a short period of time and no full development statistics derived from early years are yet available. What is then needed is some tool for judging the results, bearing in mind that rough approximations, still possibly subject to considerable variance, may be more valuable to management and to the Underwriter than an entirely unknown situation.

CASE STUDY 2

Cumulative Losses ($m)

	1978	1979	1980	1981	1982	1983	1984	1985
·25	—	2·51	2·60	1·75	2·88	1·64	3·12	1·25
·5	—	6·58	6·82	8·03	8·02	4·70	6·81	7·24
·75	11·64	12·58	14·45	17·79	15·91	9·67	12·19	11·34
1	19·57	22·23	23·87	28·56	23·33	15·53	18·16	
1·25	26·19	26·23	31·66	35·57	28·58	20·32	25·20	
1·5	30·51	31·47	39·16	40·49	32·30	23·68	28·05	
1·75	34·74	37·33	42·98	44·53	35·63	26·52	30·30	
2	36·04	41·01	46·01	45·88	37·01	28·95		
2·25	40·45	42·40	47·92	46·09	37·94	30·52		
2·5	43·56	44·73	51·47	47·92	37·88	31·82		
2·75	44·73	47·30	52·25	48·91	38·39	32·61		
3	47·17	49·21	53·18	49·66	43·11			
3·25	47·76	49·15	52·89	49·95	43·19			
3·5	48·58	50·22	53·28	51·24	43·53			
3·75	50·15	51·51	53·21	52·96	43·60			
4	50·75	51·45	52·74	52·34				
4·25	50·51	51·41	53·12	53·08				
4·5	50·19	51·06	53·13	53·26				
4·75	51·03	51·40	53·85	52·51				
5	50·91	50·82	52·91					
5·25	50·59	50·09	53·62					
5·5	50·75	51·63	54·45					
5·75	50·36	51·78	54·54					
6	50·27	51·49						
6·25	49·67	51·62						
6·5	49·74	51·85						
6·75	50·23	52·35						
7	50·39							
7·25	50·39							
7·5	50·33							
7·75	50·19							

Year	Projections on: All years 1978 to 1985 incl.	All years 1981 to 1985 incl.	
1978	51·28		
79	48·42	As developed	Ratioed up see below
1980	55·33		
81	57·34	54·72	55·25
82	45·05	43·42	43·84
83	34·61	32·66	32·98
84	38·25	36·15	36·50
85	34·59	31·83	32·14

In the third column the figures of projections have been obtained by ratioing up in the proportion that the final development figure stands in the first run to the second, so as to give a precise comparison.

9. EMPIRICAL METHODS

9.1. Lloyd's lays down certain minimum audit requirements for 'reserves to close'. They are set down in Table 1 (for 1985). The percentages were never meant, however, to set more than a minimum basis and responsible underwriters have always looked much more closely at the development of their portfolios of business to see what picture has emerged over the years and to draw conclusions from that picture as to what reserves are required. As a new underwriter has taken over a Syndicate, he has probably tended to vary the method to conform to his own preference as to method and to take account of changes he may have made in underwriting policy. As a result of all these influences, 'rule of thumb' methods have tended to emerge but always subject to a large measure of adaptive control. If properly used, the approach can be very effective. It does suffer from the defect of making changes only after the underlying causes have begun to emerge, such as asbestosis, but conservative underwriters have always prudently kept some extra reserves up their sleeves to cover such eventualities. They have been very glad to have had such 'padding' to cover the underwriting results that have emerged during the last few years.

9.2. Perhaps the chief criticism that can be levelled against the approach used is that it has been somewhat too subjective but in that it is no more than a part of the whole ethos of underwriting in the type of market that is Lloyd's.

9.3. The following two examples are probably fairly representative of the approach used:

9.3.1. The underwriter has set up arrangements to use two separate approaches so that he can compare the ultimate results produced therefrom:

(i) At the end of the year the claim advices represented by the outstanding claim figures are examined in some detail. The actual work commences about six weeks after the 31 December. Extra reserves are set up by the claims department for:

Claim advices received after the close of the books;

reserves for cases where it is known that a loss has occurred but no formal advices have yet been received;

extra reserves where it is considered that the amount shown may prove later to be insufficient or does not include expenses of settlement.

All these are simply aspects of case reserving and relate only to known claims. The account is mainly a short-tail non-marine account but inevitably it contains a measure of long-tail business. The underwriter himself then sets up extra reserves, on a fairly arbitrary basis, for the long-tail groups, based on figures being produced by his detailed underwriting statistics.

(ii) The underwriter also maintains a full development triangle for his whole account figures, net of all reinsurance outwards, and uses a straight-

Table 1

Year	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
NON-MARINE																
Short	70	25	7·5	3	1	0·5										
Livestock	50	20	5	2·5	1											
U.K. Employers' Liability	90	75	47·5	32	20	12	7	5								
Financial Guarantee	90	75	35													
Other U.S.	99	98	85	70	57·5	48	35	28	24	20	16	12	8	6	4	5
Other Non-U.S.	90	75	60	50	42	32	27	20	15	11	8	6	4	4		
MOTOR																
U.K.	65	30	16·5	9	5	2										
Canadian	80	22·5	12·5	10	8	5	3									
Other	82·5	45	27·5	17	12	9	7	5	3							
MARINE																
Time	77·5	47·5	30	17·5	11·5	7·5	6	3	3							
Yacht	85	40	15	5	3											
TLO	50	20	15	7·5	2·5											
Liability	95	85	75	60	50	40	30	20	15	10	7					
Voyage	55	25	10	5	3											
War	35	15	5													
AVIATION																
Short	52·5	20	10	2·5	1·5											
Other	95	78	63	48	32·5	20	12·5	8	6·5	5						

Note Minimum reserve is highest of estimated liabilities or above percentage of individual underwriting year's premium.

forward chain ladder method for projections on more recent years. The account has a history going some 25 years back and underwriting policy has not changed to any marked extent during that period (although the world-wide insurance market has certainly seen changes). The development pattern shown is remarkably constant.

Method (ii) has consistently given figures above those shown in method (i) and hence in practice has been used but with some extra amount superimposed by assuming that the ultimate loss ratios shown on the oldest accounts will still development a little further.

Asbestosis claims have emerged as a distinct 'bump' in the figures at a constant calendar point in time (hence at stepped development periods).

9.3.2. Mr R. J. Kiln's methods, also used on a non-marine account, have been well publicized and are the fruit of a long and distinguished underwriting career.

He has set out his approach in several lectures and provided an article for 'Reinsurance' of February 1985 dealing with some of the problems that have arisen with casualty business in the United States of America.

He divides up the account into 5 groups ranging from short-tail to ultra-long and them assigns percentage of premium for reserving purposes in a manner similar to the method currently used in Lloyd's. With careful monitoring and an Underwriter's knowledge of what is transpiring in the market, he is able to use realistic ratios and to include sufficient extra to cover additional factors that are already in the background and will almost certainly affect the results.

10. BORNHUETTER & FERGUSON[2]

10.1. The method is more a concept or an approach to the problem than a detailed technique. It consists of extrapolating the office's own data of claims or loss ratios by chain ladder method and of then comparing the results with expected values based on the premium income and expected claims derived from the office's own expectations in the light of market trends, taking whichever gives the higher results of the two.

The obvious danger is that the whole market may be misreading the signals, particularly if background factors, such as social pressure or legal decision, are causing results to worsen.

The original paper was written to cover conditions existing in the U.S.A. and for direct-written liability business rather than for reinsurance. The basis of statistics would therefore depend on earned premiums rather than on premiums booked.

While direct application of the method may be limited, the concepts used can be extended in two ways that may be valuable:

10.1.1. A concept of weighting can be introduced, giving higher weight to claims development for a year where the pattern is already reasonably clear but

less weight to claim development and more weight to expected results, for more recent years.

10.1.2. Extending the chain ladder development as far as can be taken by the figures available and then allowing for an additional IBNR factor as judged from general market development figures of claims (such as are provided by reports of the Reinsurance Association of America).

The chief complication in practice is a changing portfolio of business. Bornheutter & Ferguson talks about "possibly making judgement adjustments to reflect changes apparent in the data" but does not suggest any method by which to identify or evaluate those changes.

10.2. To use the method, the possibility of additional complications must be borne in mind.

In the U.S.A. full and adequate statistics are available of primary carriers' results. In Canada, England, other countries of the E.E.C. and Australia fairly good but less complete statistics are available and some knowledge of market results exists. In the rest of the world, very little is available.

In the London market, however, from its very nature as a market, a much more varied pattern exists. Different underwriters using the same Brokers and looking at the business in the same market, write very varied books of business. Some specialize in particular fields, some are less capable than others in exercising wisdom of choice.

In the last few years of a very soft market and very adverse results, a few underwriters were still able to underwrite consistently at an underwriting profit; many others wrote at a small underwriting loss, adequately covered by investment income and surpluses brought forward; others wrote at higher loss ratios and are now busy licking their wounds and reconstructing their capital base to meet solvency tests; yet others wrote at very high loss ratios, 200% or more on the whole account, and have now gone out of business. It is a varied pattern indeed.

To apply the Bornhuetter & Ferguson approach in these circumstances necessitates a much closer application to actual conditions. It is essential to extend the approach by:

10.2.1. Analysing the office's own results, measuring the extent to which its underwriting policy is changing (often less than the underwriter's own anticipation) and learning as much as possible of the abilities of the office.

10.2.2. Comparing the office's own results against market trends in the past and how that may vary in the future.

10.2.3. Looking at market trends generally.

10.2.4. Looking at the results attained by other offices one has examined and comparing results.

10.2.5. To employ an imaginative insight, based necessarily on a deep understanding of the market, of how trends are developing.

In general, the rule is to assume the worst but hope that those fears are not realized.

11. CRAIGHEAD MODELLING PROCESS[3]

11.1. The process stems from the modelling of development loss ratios to a curve of suitable shape where the parameters represent important and meaningful factors that can then be further analysed. A negative exponential curve has been found to be most suitable for the purpose and to fit actual data reasonably well in a substantial number of cases.

The curve used is

$$l_t = L\{1 - e^{-(\frac{t}{B})^C}\}$$

where, for any one underwriting year:

- l_t represents the loss ratio (either paid or incurred, according to choice) at development time t reckoned from the beginning of the underwriting year.
- L is the final loss ratio that will result.

The two parameters B and C are of crucial importance and are used to explain the nature of the account, as explained later below.

- B is a measure of the length of the tail. Hence the ultimate loss ratio L will be finely tuned to the value of B in any extrapolation process. Skill can rapidly be built up from experience in fitting values to the curve in a number of known examples so as then to provide the facility of realistic extrapolations where development is scanty.
- C has some effect on the length of the tail; much less than B over a normal range of C, but has more effect in determining the shape of the curve.

11.2. Some examples are given in Graphs 1 and 2.

11.3. Unfortunately the curve is not easy to manipulate algebraically and does not lend itself to any of the normal regression methods (although results can be obtained by examining the logs of the values).

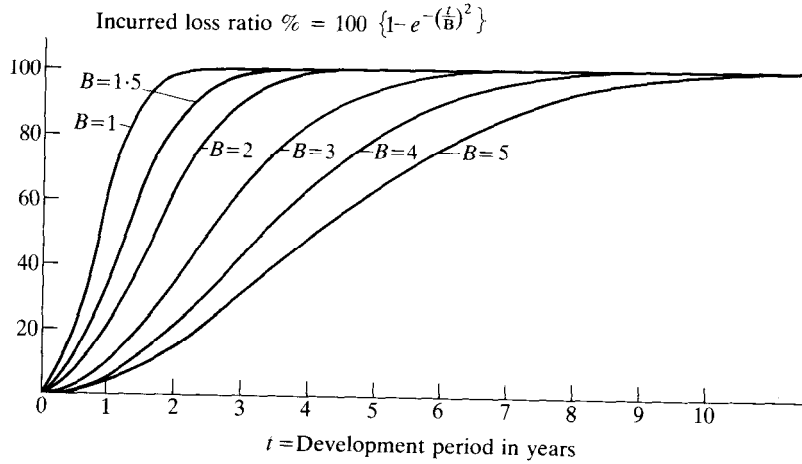
There are two possible approaches in setting up a computer system to obtain the best fit, as being the curve which minimizes the sum of the squared differences between actual and calculated values (possibly with some weighting—see later):

11.3.1. Starting with the outside lower and upper likely limits of L, say L_1 and L_2 assigned somewhat arbitrarily, the Golden Search method is used to home in on the value of L sought.

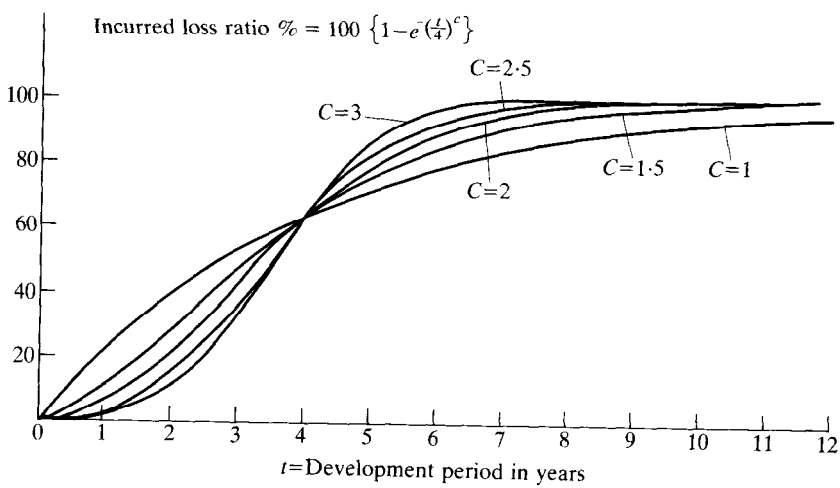
At each chosen value of L in the homing-in pattern, B and C are found by averaging. To attain that end the formula of the curve is re-arranged and then broken down by taking logs (to base e) twice, to give.

$$C(\log t - \log B) = \log\left\{-\log\left(1 - \frac{l_t}{L}\right)\right\}$$

GRAPH 1



GRAPH 2



If C is assigned a value of 2 as is suggested later (or indeed any other fixed value) then the formula reduces to

$$\log B = \log t - 1/2 \log \left\{ -\log \left(1 - \frac{l_t}{L}\right) \right\}$$

The weakness of this system is that a different criterion is used in finding the values of B and C (an averaging process) to that used in finding L (minimizing the sum of the squared differences).

11.3.2. Lower and upper limits are assigned to L, B and C and the sum of the square differences worked out for, say, every 5th value between the limits. Choosing the set that gives the lowest sum of the squared differences the program then goes, say, 10% each way and repeats the process, till the margin is sufficiently small.

What one is trying to do is to find the least value of a three-dimensional 'surface'. If the 'surface' is nearly flat then one does not necessarily find the correct set of values by this process unless the grid of values is made very finely divided each time around (which would increase the running time substantially on a micro-computer).

11.4. The loss ratios l_t tend to be very rough at the early stages of development of an account. Generally speaking, improved results can be obtained, in most cases, by minimizing the value of

$$\sum (l_t - l'_t)^2 \times t$$

That is, by weighting the values by the time elapsed.

If, however, the account is well developed and quarterly values of l_t are available so that there are a substantial number of values of l_t for higher values of t, then it is preferable not to weight the squared differences.

11.5. In practice it is found that a fixed value for C of 2·0 is most suitable. In the vast majority of cases any extra work in searching for a more specific value of C is not justified. There may be a few cases, particularly of proportional treaties, where a value of C of 1·5 is useful. Values for C of 1·25 to 1·5 can also be useful if it is necessary to extrapolate on claim settlement ratios rather than on incurred loss ratios. Such values produce a sharper increase to the curve in the early stages of development and a slower ending off, more akin to a 'drifting' of loss ratios upwards after most development has already occurred (akin to a steady effect of inflation during the period when claims have been notified but not yet settled).

11.6. In many cases the statistics available and on which extrapolations are based, are 'whole account' statistics or, even if sub-divided, make no distinction between property and liability business. Even liability business itself may involve both medium and very long tail business. A value of C below 2·0 can give a somewhat improved fit in such cases but a far better fit can be used by splitting the formula so that

$$l_t = L_s \times r_s \times \{1-e^{-(\frac{t}{B_s})^2}\} + L_l \times (1-r_s) \times \{1-e^{-(\frac{t}{B_l})^2}\}$$

where the suffix S relates to the short tail portion;
suffix L relates to the long tail portion;
and r_s is the ratio for short-tail business in the account.

Fitting the curve given by a split formula is slow work on a micro-computer but can be achieved by the approach used in method 11.3.2 above.

11.7. It is always advisable to plot the points and draw the curve obtained so as to be able to obtain a visual image of the fit. A measure of the mean square difference can give some idea but can easily be affected unduly by one or two 'out-riders', which may themselves suggest error in the data.

11.8. Once the value of C has been fixed at 2·0, more critical attention can be paid to the value of B that emerges.

When based on incurred loss ratios:

11.8.1. A very short tail Non-Marine facultative or direct property account, containing a negligible degree of liability business admixed, or a P.A account can show a value of B as low as ·8 but more usually about 1 to 1·5. Some accounts show values of B between 1·5 and 2·0 but less frequently except perhaps when dealing with Covers or Line Slips in the account, which operate much like treaties and tend to increase the value of B.

11.8.2. On the other hand, Marine or Aviation Hull or Cargo accounts tend to show slightly higher values of B, more like 1·5 to 2·25.

11.8.3. There is very little point in trying to separate out proportional treaty business between short- and long-tail as most treaties contain both and the block claims, which cover a large proportion of the claim totals of the treaty, make little attempt to give sufficient information to obtain such a split.

Non-Marine treaties, particularly from the U.S.A., are often written on a cut-off basis by means of portfolio transfers. That factor would tend to reduce the value of B but the cut-off arrangements tend to vary from one treaty to another and not all Non-Marine treaties carry portfolio transfers.

Non-Marine and Aviation Proportional treaties almost always produce values of B between 2·25 and 2·5; sometimes up to 3·0. A split formula can be helpful.

Retrocession treaties are dangerous and can produce significantly higher values of B.

11.8.4. Liability business can be very variable. Values of B tend to vary between 3·0 and 6·0, depending much on how the business is written.

11.8.5. Non-proportional treaties are the most variable in their effect depending both on what classes of business they embrace, also what level of excess points is involved and how claims accumulate for purposes of recovery. Most dangerous are excess loss treaties which include high amounts of liability business and have been written on a losses-occurring basis. Values of B of 5·0 to 6·0 can emerge. A claim-made basis should reduce the length of the tail substantially but there are dangers involved.

Of particular danger are 'second time around' treaties of the LMX type although usually a very adverse result tends to manifest itself fairly early on.

11.9. The values of B emerging should then provide the basis of discussions with the Underwriter.

11.10. With a value for C of 2·0, the values of B have one very useful property. If $B = t/2$, then

$$l_t = L\{1 - e^{-4}\} \text{ which is } 98{\cdot}2\% \text{ of } L$$

In other words, the loss ratio has reached very nearly its ultimate value when the elapsed time t is equal to $2 \times B$. An inspection of development results can often give a fairly clear indication of the value of B that is likely to emerge.

11.11. One commences by fitting curves for the cell of business being examined, starting with the oldest year and working forward, watching the changes in the value of B. It should be roughly constant, say within 10% to 15% of a mean value. If so, then if early years are already sufficiently far developed to give some degree of confidence in the results, that mean value can be applied to later years, not yet so well developed.

If the value of B has shown a tendency to increase, then even higher values can be used for later years of account. If they have shown a tendency to decrease, then caution should probably be used and a value no lower than the end value of the list used for later years.

If no clear pattern exists, and in any case where judgement must be exercised, lessons can be drawn from experience elsewhere as to what values of B to use. It is at this point that general knowledge of the market can be used in modifying results.

11.12. Extrapolation on one year's figures (4 quarters' figures) is always of highly dubious value although in a short-tail account, using pre-determined values of B, some indications can usually be obtained.

Extrapolation on two years' figures (8 quarterly points) is somewhat better but must still be hedged about with qualifications in the case of medium or long-tail accounts.

Extrapolations at the 3 year point, where accounts are usually closed, should have 12 quarters' figures to back them up. For short-tail accounts they should already be fully developed. For long-tail accounts the first real trial of extrapolation must be attempted. Having a pre-determined value of B is of great assistance in such an exercise but it also proves to be a salutary exercise to graph the results, if only to see the extent of the extrapolation process involved.

Fitting a curve by a method which determines its own value of B can be a dangerous exercise at the 3 or even 4 year point of a very long-tail account.

11.13. Some examples of applications of the modelling procedures are given in Case Studies 3–6, which, with the corresponding graphs, are shown on pp. 436–451.

11.14. The chief criticism that must be levelled against any method of projection by modelling is that the development figures must fit to a curve of pre-

determined shape. The actual shape of the curve can be modified and 'pulled' or 'squeezed-back' in several ways by changing the parameters or using a combination of 2 sets of parameters but the ratios are forced to conform to the shape available.

When comparing patterns of development, however, it is necessary to compare like with like. For example the figures given by the Reinsurance Company of America are based on accident year, not on underwriting year (which means very roughly exposure year) as in the London Market. Furthermore, loss ratios as drawn from American statistics are likely to be based on earned premiums, which are quite different to booked premiums in a reinsurance portfolio.

In a short-tail account, one can normally expect to estimate within 1%–2% of the ultimate result at the end of the third year of development, narrowing down even further thereafter.

In the case of a proportional treaty containing only a small casualty element one can expect to estimate within 3%–4% of the final result at the end of the third year.

With a typical casualty long-tail account, incurred losses at the end of the third year will only be some 35% of those ultimately expected, even without any unusual factor intervening and one is doing well by being within 10% of the correct figure. It is under these conditions that a modelling process becomes extremely valuable. It becomes a yard-stick against which various assumptions can be tested.

The curve is almost always approximately of the right shape and its use provides very powerful tools in both gaining an insight into the business and in projecting for more recent years of development.

One case where use of the curve may not prove fully satisfactory is where, after several years of development with virtually all claims advised, actual settlement of outstanding claims may be at figures higher than anticipated due perhaps to the effect of increasing levels of inflation, so leading to loss ratios that drift slowly upwards. Investment income available should cover this feature in practice but there may be instances, particularly where no residual fund exists, of a need to include an extra reserve. It could be a percentage (say 20% or 30%) of outstanding claims plus any residual IBNR reserve anticipated, for those underwriting years to which the incurred losses can reasonably be assumed to be fully developed; that is, for development years t in excess of 2·25 times the value of the parameter B being used with, perhaps, a reducing percentage or a percentage of the premium for more recent years.

CASE STUDY 3

Aviation business. Incurred Loss Ratios.

Elapsed period	Year of Account 1976	1977	1978	1979	1980	1981	1982	1983
·25	0	0	0	80,665	8·4	0	0	0
·5	0	690·7	0	0	11·2	0	135·1	5·6
·75	43·5	274·4	88·8	2,339	776	91·4	51·4	56·5
1	168·1	440·9	96·0	89·3	133·9	93·1	95·6	107·4
1·25	67·4	229·4	91·1	89·8	114·0	87·3	91·2	90·5
1·5	158·7	179·7	95·9	80·4	99·5	77·0	85·7	82·7
1·75	136·2	295·2	98·2	72·6	107·2	79·9	91·1	112·6
2	128·0	149·1	97·4	108·1	102·6	87·4	93·2	
2·25	127·4	150·2	98·3	111·3	103·4	99·3	91·3	79·6
2·5	138·9	117·9	104·9	111·6	106·7	104·8	88·7	80·4
2·75	130·5	122·8	104·5	117·7	108·2	109·8	90·4	84·4
3	143·4	134·4	122·5	116·0	117·3	119·4		84·7
3·25	147·8	140·1	127·8	122·8	121·6	119·1	89·7	
3·5	151·9	138·6	124·4	128·2	126·0	123·1	90·5	
3·75	160·1	140·9	133·0	135·2	137·5	132·9	90·8	
4	150·6	136·2	125·3	140·9	145·9		91·6	
4·25	152·1	132·2	127·8	144·8	145·9	129·1		
4·5	151·9	136·3	130·3	150·0	147·8	133·0		
4·75	156·4	142·3	134·2	149·7	143·6	134·4		
5	158·8	150·0	136·1	155·5		137·4		
5·25	155·8	153·2	134·7	154·6	143·4			
5·5	151·4	142·7	135·6	153·9	143·9			
5·75	150·2	142·5	133·0	150·5	144·0			
6	151·4	142·3	134·3		144·6			
6·25	150·4	142·5	135·3	152·2				
6·5	142·3	143·7	135·3	155·5				
6·75	139·0	141·7	135·6	155·6				
7	140·9	138·6		155·8				
7·25	140·8	138·7	136·0					
7·5	140·6	138·9	138·2					
7·75	141·2	139·1	138·2					
8	141·2		138·5					
8·25	141·1	142·0						
8·5	153·1	140·2						
8·75	145·0	140·2						
9		140·2						
9·25	144·6							
9·5	146·3							
9·75	147·2							
10	147·6							
				Computer modelling				
$L=$	151·1	141·1	130·4	148·6	137·5	131·1	90·4	96·6
$B=$	2·0	2·0	1·78	2·0	1·88	1·76	1·18	1·34
B fixed			2·0		2·0	2·0	2·0	2·0
$L=$			137·8		143·2	137·9	108·9	130·0

Case Study 3 (*continued*)

Comments:

(1) The Company ceased underwriting in 1983.
(2) The Aviation portfolio is a mixture of business, including facultative reinsurance and treaties, both proportional and non-proportional. No break-down is available but the bulk is proportional treaties (some 90% in earlier years reducing to about 80% in 1983).
(3) As is often found in Aviation business, loss ratios are substantial in early periods of development. In such cases the modelling fit is started from a later point (indicated by the dividing lines).
(4) No values were available as at December 1984.
(5) The B values are highly consistent. Even where lower than 2·0, a pre-determined value of 2·0 appears to provide a more reasonable result.
(6) For 1982 it was decided to use the projection given by the pre-determined value of $B = 2{\cdot}0$, giving $L = 108{\cdot}9\%$.
(7) There were administrative difficulties in regard to data relating to the 1983 account and some of the loss ratios given are suspect. The modelling fit with B pre-determined at 2·0 gives a rather high result. On reflection, it was decided to use an ultimate loss ratio proportioned to the 1982 result by the ratios at the latest compariable development periods. A figure of 122·3 was produced thereby.

CASE STUDY 4

Non-Marine business. Incurred Loss Ratios.

Elapsed period	Year of Account 1976	1977	1978	1979	1980	1981	1982	1983
·25	0	0	0	181,286	0	0	0	0
·5	53·8	32·1	35·6	130·8	118·6	64·6	60·3	
·75	75·4	27·8	46·8	71·2	56·8	55·2	44·0	
1	73·9	36·9	44·0	101·2	61·5	63·0	76·0	184·4
1·25	81·2	66·1	48·0	124·8	78·9	86·0	89·4	189·3
1·5	102·0	81·6	63·2	99·0	87·0	111·5	101·8	102·7
1·75	112·7	87·8	78·7	101·0	85·3	109·5	104·7	173·4
2	105·3	91·1	94·7	102·3	99·8	111·2	112·4	
2·25	100·9	99·9	101·3	101·4	109·3	121·0	115·3	122·8
2·5	97·8	100·2	99·2	97·9	112·2	123·1	123·3	123·1
2·75	100·0	99·1	101·3	100·2	111·8	129·3	141·9	135·1
3	101·8	99·0	95·5	101·1	117·0	135·4		140·9
3·25	105·2	101·9	94·2	107·0	125·3	139·0	118·3	
3·5	104·5	102·1	92·4	108·8	130·8	141·8	129·2	
3·75	102·6	99·0	94·1	113·7	135·6	151·0	130·3	
4	102·1	98·3	90·5	121·1	136·6		133·4	
4·25	105·1	99·5	90·6	124·8	137·9	147·8		
4·5	102·6	98·4	91·8	125·5	143·5	154·4		
4·75	103·0	99·0	91·8	127·6	152·8	155·0		
5	105·1	98·3	92·0	130·2		159·0		
5·25	102·0	98·9	95·6	130·9	150·4			
5·5	101·0	99·3	95·9	134·4	157·2			
5·75	100·4	99·8	95·2	138·2	157·2			
6	101·4	100·6	95·0		161·5			
6·25	104·5	101·6	95·2	144·4				
6·5	103·6	101·5	95·7	148·3				
6·75	103·7	102·3	97·0	151·7				
7	103·5	102·2		163·2				
7·25	104·4	101·7	96·0					
7·5	104·6	101·8	97·3					
7·75	105·1	102·1	97·3					
8	104·8		97·5					
8·25	105·9	95·2						
8·5	107·0	105·0						
8·75	107·7	105·0						
9		105·4						
9·25	112·4							
9·5	108·5							
9·75	108·5							
10	108·4							

Case Study 4 (*continued*)

				Computer modelling				
$L=$	97·7	102·6	97·4	137·3	148·4	142·6	118·3	
$B=$	·786	1·5	1·5	2·0	2·0	1·59	1·11	
B fixed	1·5					2·0	2·0	
$L=$	108·2					160·1	153·6	
Double set of parameters								
L_S				154·8	130·1	134·5	115·1	112·3
L_L				154·8	220·7	224·2	251·9	279·0
L				154·8	167·2	163·2	137·0	154·0
B_S				·49	·806	·856	·896	·896
B_L				4·4	3·78	3·1	2·5	2·48
R_S				·52	·59	·68	·84	·75 fixed

Comments:

(1) The ratios given above are for the Non-Marine A/c of the same Company as in Case Study 3 and suffer from the same defects as the Aviation figures. The volume of business involved is substantial.

(2) The proportional treaty content is judged to be small in the early years but increasing to some 90% of the whole in the 1983 account.

(3) While years of account up to 1978 show a predominantly short-tail account with $B=1{\cdot}5$ giving good modelling fits, the results from 1979 onwards become more doubtful. This feature was confirmed by

   (i) Drawing the graphs, where the picture became very clear (see Graph 3).

   (ii) Discussions with the Management who advised that, from 1979 onwards, a good deal of long-tail business was written, mainly under retrocession treaties.

   Two steps were then taken:

   (a) To model by means of a double-parameter curve, with the results as shown. These appeared to be much more satisfactory. See Graph 3 relating to 1980 account.

   (b) To obtain figures of the half-dozen largest treaties and set up development triangle statistics for them, so as to see what further effect they might have on the total picture and whether returns were up to date. As a result, it was decided to hold some extra reserve over and above the figures now given by the projections.

(4) There is some evidence in the development figures of a small but definite 'drift' in loss ratios at the longer periods of development. To cover this aspect, it was decided to add an extra reserve of a proportion of outstanding claims and IBNR, the proportion reducing for later years.

CASE STUDY 5

Whole A/c gross of R/I outwards—section settled in £ only.
Incurred Loss Ratios.

Elapsed period	Year of Account 1977	1978	1979	1980	1981	1982	1983	1984	1985
·25	13·36	17·45	47·46	15·57	·78	5·42	25·18	8·97	16·16
·5	24·72	17·35	38·13	14·46	8·95	20·34	19·28	17·55	34·89
·75	24·17	26·25	40·00	32·42	11·33	29·44	26·83	27·10	27·85
1	24·17	44·84	56·95	39·66	33·97	40·04	32·75	32·98	46·23
1·25	32·95	59·96	67·24	48·42	38·75	51·69	38·58	51·86	
1·5	37·13	56·62	78·06	57·87	53·86	65·85	50·03	68·55	
1·75	38·56	67·18	86·44	70·90	71·14	72·44	65·51	73·09	
2	45·52	81·50	88·69	73·33	83·04	82·66	72·46	77·71	
2·25	49·00	88·68	86·19	76·06	86·78	84·22	79·04		
2·5	49·76	89·48	94·50	80·26	88·97	93·39	89·01		
2·75	56·43	87·21	94·06	82·75	91·66	96·45	97·31		
3	61·16	88·28	92·55	81·36	91·78	106·26	100·28		
3·25	59·45	86·35	93·21	83·34	90·70	102·08			
3·5	59·70	87·42	96·59	84·50	89·83	105·42			
3·75	66·54	87·40	95·76	85·50	91·73	107·84			
4	64·37	85·03	97·55	93·14	90·61	112·95			
4·25	65·47	84·32	100·10	91·47	91·04				
4·5	65·87	81·27	99·52	91·55	91·64				
4·75	66·63	81·50	98·29	90·05	90·77				
5	66·67	81·96	98·09	87·87	91·03				
5·25	70·43	82·19	95·62	85·57					
5·5	67·74	82·66	94·15	84·85					
5·75	71·44	83·12	94·21	86·08					
6	77·71	83·50	92·94	86·13					
6·25	78·55	79·40	90·97						
6·5	77·12	82·66	91·61						
6·75	77·16	82·32	91·44						
7	77·10	82·72	91·68						
7·25	78·15	81·25							
7·5	76·63	82·26							
7·75	76·59	81·90							
8	78·63	80·77							
8·25	78·53								
8·5	78·11								
8·75	77·22								
9	76·28								
(Ratio short-tail) (pre-determined)	·79		·824	·807	·705	·687	·678		
L_S	51·5		93·7	104·5	86·4	111·0	84·0		
L_L	180·6		99·4	44·6	117·6	199·8	220·0		
L	78·5	84·1	94·7	88·3	95·6	138·8	127·8		
B_S	1·12	1·25	·918	1·26	1·28	1·26	1·47		
B_L	4·16		1·856	3·06	2·0	4·30	3·01		

Case Study 5 (*continued*)

Notes:

(1) The account is a Lloyd's Syndicate writing Non-Marine business. The proportion of long-tail business is known and the curve-fitting has been effected by finding the best fit as being given by the sum of two curves, except for the 1978 A/c where a better fit was obtained with one set of parameters.

(2) Projections were also made separately on the short- and long-tail sections of the account and the two results compared. As a result the ultimate loss ratio anticipated in the 1979 was increased from 94·7% to 96·2% and in the 1980 A/c from 88·3% to 93·4%. The curves that follow have been drawn accordingly but against the whole account ratios unaltered.

(3) The 1983 projection requires great care. The program based on 2 sets of parameters was re-run but without a pre-determined ratio of short- to long-tail. The result gave $L_S = 76\%$, $L_L = 178\%$, $L = 138{\cdot}8\%$, $B_S = {\cdot}88$, $B_L = 2{\cdot}84$, $r_S = {\cdot}384$ which result differs from that previously obtained. Both could actually be reasonable projections as shown on the graph.

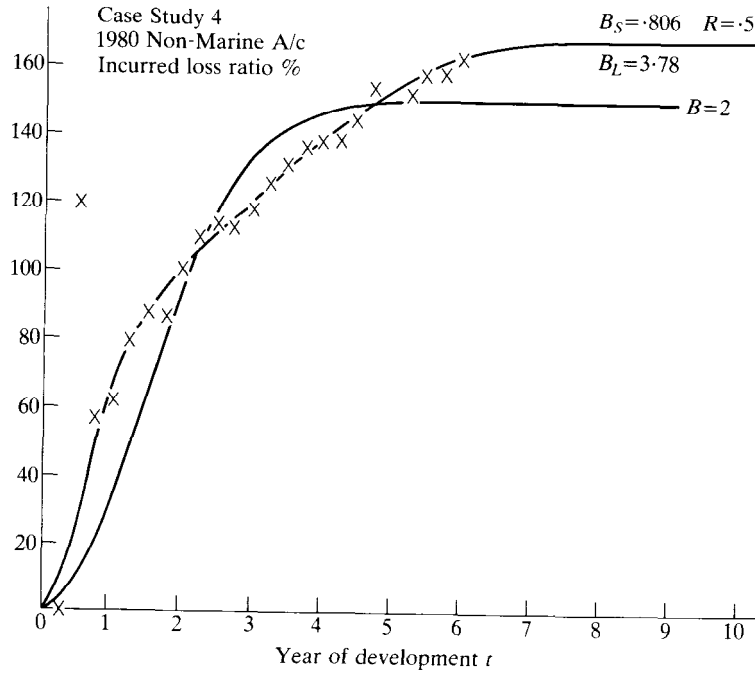
(4) Reinsurance outwards involved a not inconsiderable proportion of the account in terms of premium income but difficulty was encountered in moving from the gross to the net account. No records were available on outstanding R/I claim recoveries prior to the last 5 quarters and hence no easy projections could be made on the net account (although they were tried). It was thought, due to the effect of excess loss R/I protections at high levels, that the reinsurance outwards would be shorter tail than the gross A/c but there was no clear evidence to that effect. The method chosen was to compare net incurred loss ratios with gross as at the most recent point in time and:

   (i) if the net incurred loss ratio was higher than the gross, to ratio up the ultimate loss ratio anticipated in that proportion;

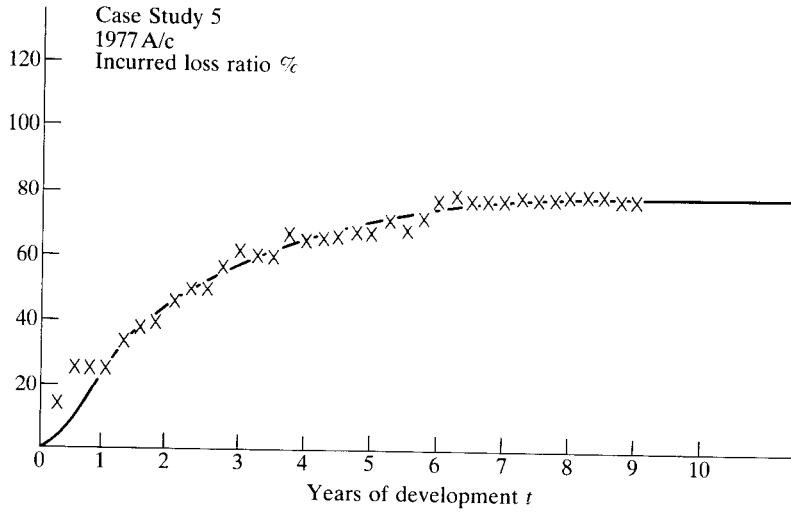
   (ii) if the net incurred loss ratio was lower than the gross, to ratio the ultimate loss ratio down by two-thirds of that proportion.

   Greater difficulty arose with the 1983 U.S.$ account where American storms had influenced the gross account considerably but the net account proved to be adequately protected. Several approaches were adopted before a decision was taken, being to deduct the special claims involved from both the gross and net account, do projections without those claims and then add them back in. The catastrophe claims were mainly very short-tail but could also, in the longer duration, affect the LMX assumed part of the account.

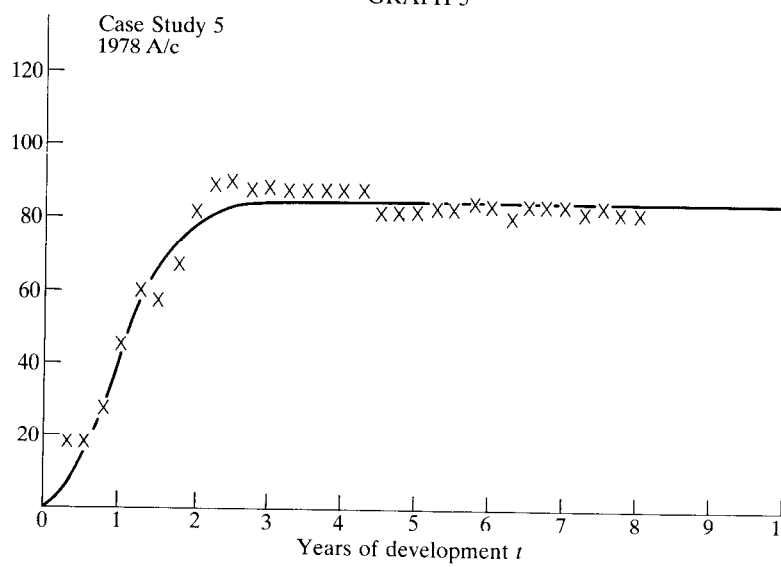
GRAPH 3


Case Study 4
1980 Non-Marine A/c
Incurred loss ratio %
B_S=·806 R=·59
B_L=3·78
B=2
160
140
120
100
80
60
40
20
0
1
2
3
4
5
6
7
8
9
10
Year of development t

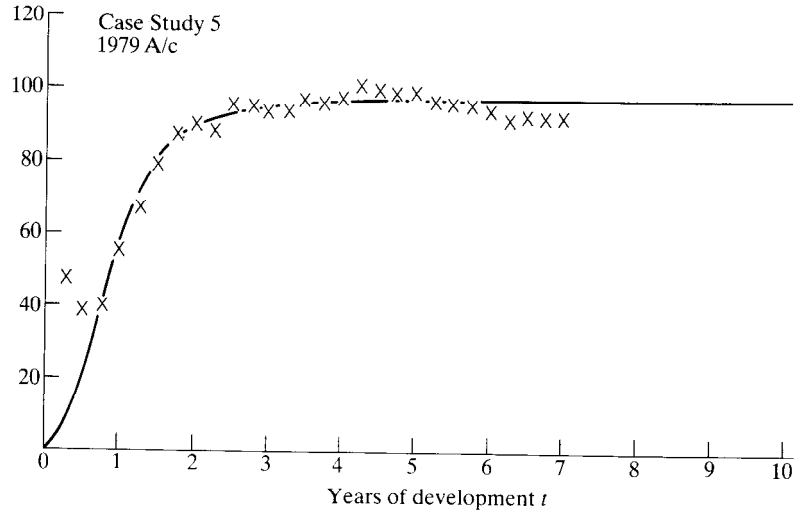
GRAPH 4



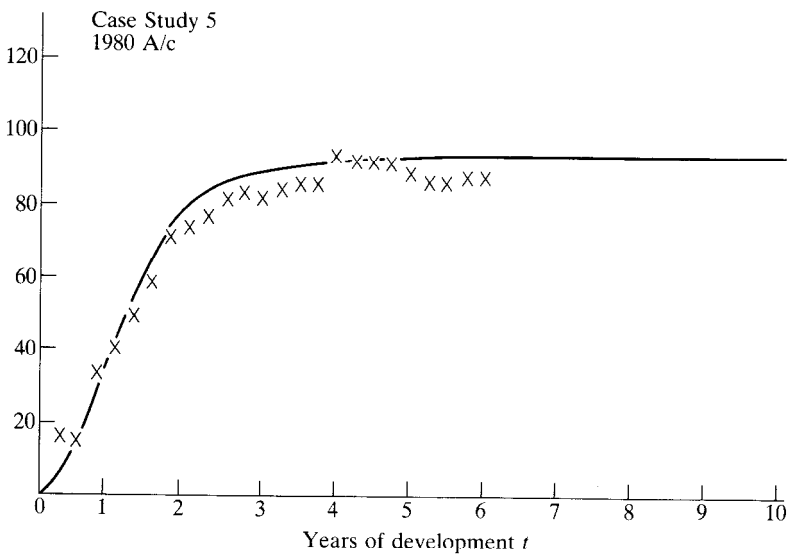
GRAPH 5



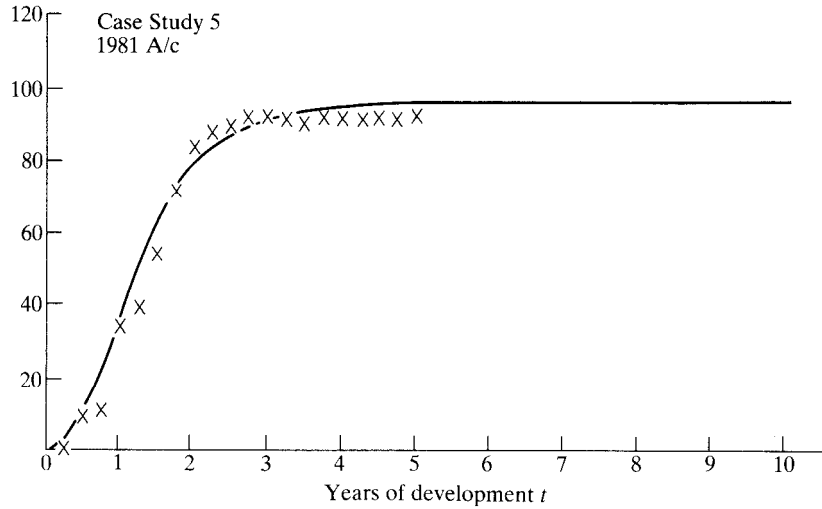
GRAPH 6



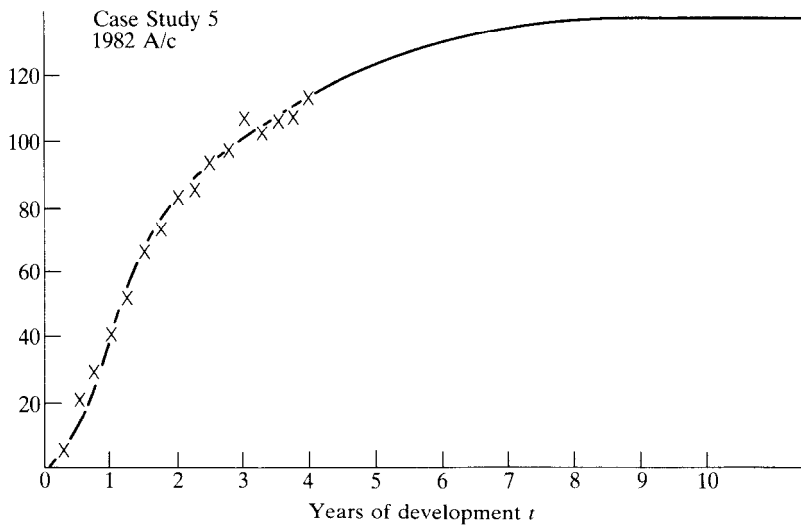
GRAPH 7



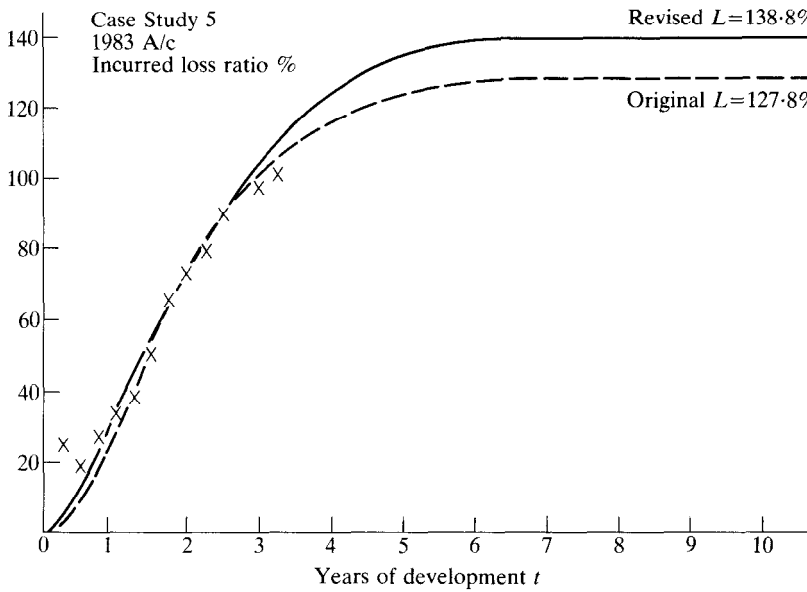
GRAPH 8



GRAPH 9



GRAPH 10


Case Study 5
1983 A/c
Incurred loss ratio %
Revised L=138·8%
Original L=127·8%
140
120
100
80
60
40
20
0
1
2
3
4
5
6
7
8
9
10
Years of development t

CASE STUDY 6

Liability Business. Facultative, U.S.$ only. Incurred Loss Ratios.

Elapsed period	Year of Account 1975	1976	1977	1978	1979	1980	1981	1982
·25								0
·5								0
·75							0	0
1							0	0
1·25							0	0
1·5							0	0
1·75						0	0	2·9
2						0	16·3	3·7
2·25						36·7	16·2	15·4
2·5						36·2	17·2	18·4
2·75					15·3	36·1	22·8	10·1
3					12·0	32·8	28·8	10·1
3·25					23·9	57·6	33·5	32·8
3·5					28·3	45·5	46·0	33·1
3·75				36·0	38·5	69·1	37·1	51·2
4				26·0	39·0	68·6	38·8	52·6
4·25				34·7	36·4	83·3	52·4	52·9
4·5				37·3	63·6	84·6	52·4	
4·75			62·0	41·5	64·7	72·9	57·4	
5			31·3	58·0	67·7	67·1	95·7	Account
5·25			69·9	57·1	145·6	84·7	96·2	small
5·5			85·7	68·5	150·4	86·1		
5·75		37·8	96·1	79·6	176·6	99·0		
6		30·9	101·5	80·2	176·6	112·5		
6·25		36·6	103·7	86·0	176·6	112·5		
6·5		42·9	108·6	89·0	197·3			
6·75	64·8	45·1	120·5	101·0	197·5			
7	38·8	48·1	121·6	100·2	190·1			
7·25	65·0	50·2	125·3	121·0	207·4			
7·5	77·8	46·7	146·1	132·3				
7·75	80·0	51·4	161·7	129·9				
8	114·9	51·9	177·5	139·8				
8·25	111·9	51·5	182·4	141·1				
8·5	114·8	67·4	152·9					
8·75	117·9	73·1	143·0					
9	111·4	72·5	166·5					
9·25	111·2	118·1	174·6					
9·5	106·3	122·8						
9·75	116·0	129·4						
10	113·6	126·1						
10·25	118·2	128·6						
10·5	138·3							
10·75	148·1							
11	150·6							
11·25	151·7							

Comments:

(1) Being a liability account, the development loss ratios can be expected to be 'rough', that is, to fluctuate considerably.

(2) The account was fairly substantial in size up to year 1978 but thereafter was reduced substantially.

(3) The account must be expected to be very long-tail.

(4) Figures are available only from September 1981 and whatever projections are made must be attempted on the basis of such figures as have been made available. The first line of figures looks suspect when compared to the second line and is perhaps better disregarded.

(5) The incurred loss ratios for underwriting years 1975 and 1976 show sudden sharp increases in March and June 1986, resulting from increases in outstanding loss advices rather than in settlements. On querying the matter, it transpired that there had been very long delays in advices received from certain cedants in the U.S.A. who were no longer underwriting but where an attempt was being made to clear the backlog of work. There were also substantial asbestosis claims involved.

(6) Although figures are not available for the period prior to September 1981 it is known that the liability account produced relatively few loss advices prior to that date and it had even been anticipated at that stage that the account would prove very profitable.

(7) The curve used in modelling does not fit at all well but the fit can be improved substantially by reducing the elapsed period t by a constant n per underwriting year,

$$l_t = L\{1 - e^{-(\frac{t-r}{B})^2}\}$$

By trial and error methods, the best fit then becomes

Year	Deduct	L	B	Mean square diff.
1977	2·75 years	177·7%	3·64	173·0
1978	1·25 years	274·3	8·07	24·1
1979	2·75 years	226·7	2·80	242·4

(Does not apply to years 1980/1/2.)

The 1978 year appears to be the odd one out. Taking the deduction as 2·75 years for 1978 we get

1978	2·75	162·7	3·9	51·0

which looks more correct particularly as to the value of B.

See Graphs 11, 12 and 13. The fit looks good except for the earlier durations in the 1978 account.

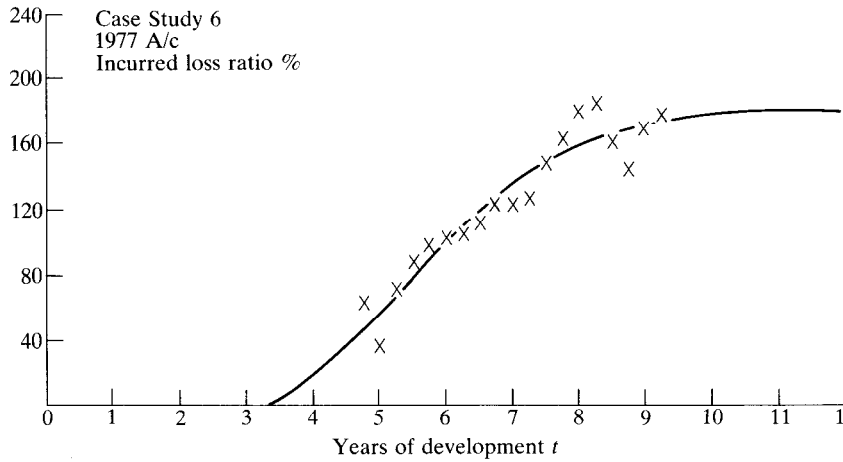
(8) The development points are rough and one would prefer additional margins of safety, perhaps by increasing the value of B somewhat.

(9) Similar assumptions were then made as to the 1975 and 1976 accounts,

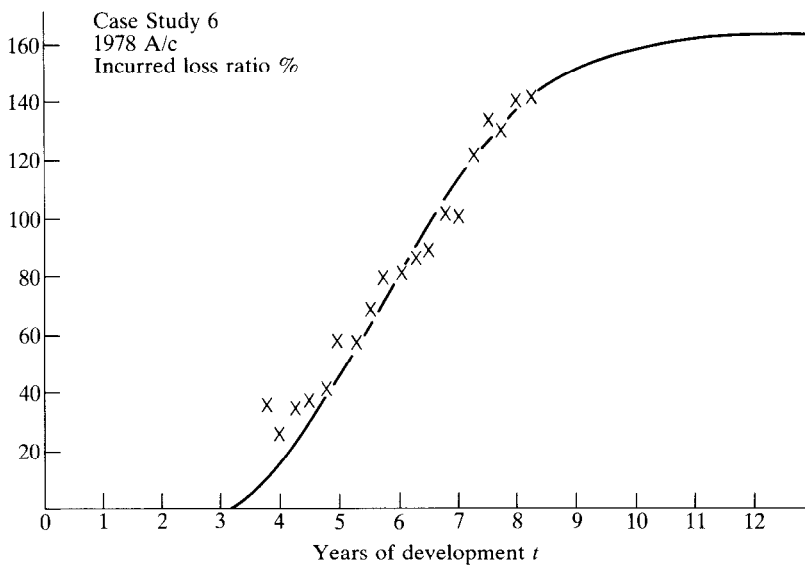
using a projection model with development period $t-2{\cdot}75$ and a suitably high value of B.

(10) Fortunately the liability account forms only a small part of the whole account: less then 5%. It is class 7 of the D.T.I. classes that was under examination. More recently, however, it has been realized that class 9 (Non-Marine, non-proportional treaties) includes a fair number of retrocession treaties, some of them large in amount, that contain much liability business. A complete separation of the group with figures going back some time could not be obtained. The investigation accordingly centred on a more detailed examination of several of the largest treaties. As a result of the investigation, the group was separated out and forecast assumptions made similar to those of class 7.

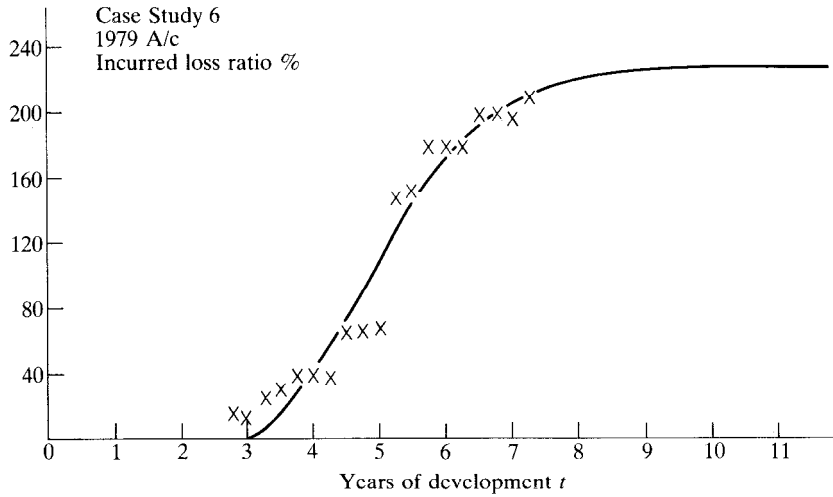
GRAPH 11



GRAPH 12



GRAPH 13


Case Study 6
1979 A/c
Incurred loss ratio %
240
200
160
120
80
40
0
1
2
3
4
5
6
7
8
9
10
11
Years of development t

12. FURTHER DEVELOPMENTS BY BENJAMIN & EAGLES[4]

12.1. The paper submitted to the Institute recently contains a great deal of useful direction in the calculation and setting up of reserves in the London Market and should be read in detail to appreciate its full value.

There are two specific developments set out in the paper that merit close attention:

12.1.1. The plotting of loss ratios at a given point of development (1 year, 2 years and 3 on) against ultimate loss ratios as obtained by projections of the Craighead type to obtain a line of regression which leads to a simple formula for purposes of projection and, in particular, for use in the Lloyd's system of minimum reserves.

12.1.2. The development, from the same basis of plotting, of confidence limits.

12.2. The method suggested are powerful and have several advantages as a first step in the right direction but there are also limitations which should be recognized:

12.2.1. The regression line suggested is derived from back data. It relies on that back data giving consistent results. In other words, it assumes that the length of the tail and the development pattern generally is not changing. The basic assumption is therefore similar to that underlying use of the ladder method.

12.2.2. Application of the factors obtained from the line of regression involve extrapolation on the basis of the last figure of development shown. Where ratios (or amounts) are as 'rough' as those found in London Market business, it is preferable to use all back figures available as a base for the projection, preferably with a weighting factor in favour of later figures.

12.2.3. My own experience indicates that loss ratios at the end of the first year of development give of themselves little information as to final loss ratios anticipated except in the case of very short-tail business. Even those at the end of the second year of development are not much clearer in their indications. By the end of the third year one has a reasonable basis of projection but only when using quarterly or at least half-yearly figures to date—the last figure by itself is still unlikely to be useful without assistance by other, earlier, development ratios.

There are examples available where I should have found great difficulty in obtaining suitable lines of regression along the Benjamin and Eagles' method.

12.2.4. Consideration of the confidence limits involved is useful to the actuary examining the strength of the office and advising on solvency requirements. It is also useful to the directors and management of the office and some comment is often requested from the actuary. Hence the suggestions made by Benjamin and Eagles are attractive but their calculation appears to depend more on practical *ad hoc* indications than on any theoretical basis.

What is the probability of the lower and upper limits of the ultimate claims

ratios indicated by the confidence limits suggested not being exceeded? Is it 10% or 5% or 1%? Who is to say that the line should be parallel or even straight? Why not an expanding funnel?

Most loss ratios in the London market exhibit two features:

temporary 'roughness' due to disrupting factors;
a high degree of variability.

If the last claims figure available for projection is unusually high the increase may be due to a large claim which has only recently been notified but on which reinsurance recoveries have not yet been put through the books. Or perhaps the recoveries are in the excess loss protection group of business which is not split to individual classes and therefore does not net down the figures currently under consideration.

Quite apart from practical difficulties we have simply not developed the theory or application of confidence limits as applied to reserving calculations sufficiently far to be able to quote them in practice.

Variation in the development ratios given by the chain ladder method may afford a starting point but more work requires to be done as to the nature of the distribution function of the variance.

In the meantime, generalized comments may have to suffice.

13. SPECIAL FEATURES

13.1. There are several factors that have arisen in the last few years, more particularly as side-effects of the very soft market that has existed. Those special features are worth mentioning:

13.1.1. Very long delays have existed in the submission of returns on retrocession treaties both in the U.K. and overseas, more particularly in the cases of offices where a certain degree of administrative chaos has existed. Returns are now rapidly being brought up to date, showing resultant distortions in development figures based on the period of receipt of information by the reinsurer.

13.1.2. Where certain reinsuring offices and brokers have become insolvent, chaotic conditions can result in the market. Brokers or cedants may simply fail to advise on figures of returns or may hold up either premium or claim advices or both.

13.1.3. If a Fronter is insolvent, figures may fail to be advised through to the ultimate Reinsurer.

13.1.4. Where claim recoveries from certain reinsurers may be very slow to be recovered, through the effects of currency difficulties or where certain reinsurers are insolvent, partial payments by brokers result. The accounting becomes very complex. There are cases where monies have been paid to the wrong recipient and may not be recoverable by the correct ones.

13.2. A few further special points should be mentioned.

Reinsurance protection has always played a significant role in the London Market. When estimating reserves, projections should always be made, wherever possible, on both the gross and net account and the results compared.

While the gross account is split between different classes of business and between long- and short-tail, separate figures are likely to be netted down only insofar as facultative reinsurance and surplus treaties outwards are concerned.

The excess loss protections, written on a non-proportional treaty basis, usually provide the main ramparts of protection against high claims and are written on a whole account basis, split down at most between non-marine, marine and aviation business but even then with a whole-account back-up. If the figures are allocated to classes by means of a split dependent on premium income or other similar basis, then the claims must be allocated individually for the method to be valid.

Certain special points should be mentioned in addition:

13.2.1. Stop loss reinsurances without an upper limit can have a disastrous effect on LMX business.

13.2.2. While losses in the hands of a cedant office are accumulating below an excess point, that fact may not be advised to reinsurers at all. Once the excess point is exceeded, further losses can stream through.

13.2.3. Once the total number of reinstatements available on an excess loss reinsurance treaty have been used up, further losses accumulating can stream through without reinsurance protection.

13.2.4. Many retrocession treaties include the reinsurance of parts of non-proportional treaty business, with a resultant change in the pattern of development that can be expected.

13.3. If the excess loss protections have low excess points then the reinsurance outwards account, if analysed by itself (as usually it must be), is likely to exhibit a 'length of tail' feature approximation to the account as a whole.

If the lowest excess points are high, then the tail will be short for catastrophe type claims. Other types of claims are unlikely to accumulate sufficiently to reach the excess points.

13.4. If a constant rate of exchange between, for example, U.S. $ and £ per underwriting year has been used in producing the only statistics made available for purposes of calculating IBNR, the resultant reserves must be multiplied by a correcting factor to bring them into line with the current rates of exchange used in accounting. For example, if a rate of exchange of U.S. $ to £ of 2·4 has been used for, say, figures relating to the 1980 underwriting year, then the dollar content of the reserves (which may have to be estimated) must be multiplied by 2·4/1·5 if 1·5 represents the current rate of exchange).

If premiums and claims have been calculated at the fixed rate of 2·4 but claims outstanding at the current rate, then the development figures must first be corrected.

For example, say the dollar content is judged as being 60% when taken at an exchange rate of 1·4. Then, at each development point in the above example, the figures of outstanding claims must first be multiplied by

$$\frac{1 + {}^{2\cdot1}/_{2\cdot4}}{1 + {}^{2\cdot1}/_{r_c}}$$

separately, where r_c was the current rate of exchange used in the statistics at each point of time as then produced.

The final figure of reserves must then be multiplied by

$$\frac{1 + {}^{2\cdot1}/_{2\cdot4}}{1 + {}^{2\cdot1}/_{r_a}}$$

where r_a is the rate of exchange used in the accounts.

13.5. It is wise to be particularly wary when advising an office in which the administrative work of recording the data of premiums and claims has been in arrear. At best, the reserves are likely to be underestimated. Worse in effect is that it is highly likely that the recording of claims will have been more in arrear than those of premiums and claim notification advices of outstanding claims worst of all. The percentage of clerical errors arising in a panic situation with the approach of the end of an accounting period is also likely to be high. All in all, the true level of reserves required can be severely underestimated.

13.6. Asbestosis claims had a major impact on the market not only due to the very long delay in reporting but also due to non-accumulation features insofar as excess loss protections were concerned. In most cases accumulation was per cedant per underwriting year.

There are also still likely to be further claims arising from the use of asbestos fibre in large quantities in ships, schools, halls, factories and so on.

14. DISCOUNTING

14.1. If discounting is being taken into effect then a number of factors came into account additional to those normally involved. They are:

14.1.1. Considerably fuller attention should be paid to possible future inflation. The rates of inflation being considered are world-wide rates weighted in accordance with the spread of business of the office concerned and applicable to insurance claims rather than to any inflation index such as the R.P.I.. Furthermore, since inflation (and the effects of discounting) will apply more particularly to long-tail business, it is liability claims chiefly that will be under consideration.

Insurance liability claims have been increasing very rapidly in the U.S.A. as a result of social and legal pressures. One estimate has given a rate of inflation in recent years of 22% p.a. In other countries the rate of increase has been less

dramatic but is still well above R.P.I. figures or even income inflation index figures.

All methods of projection in use assume a continuation of inflation in the future at the same rate as it has occurred in the past.

One cannot tell whether claim outstanding advice figures, usually as given by the defending solicitor (attorney), are estimates of what the claims are most likely to be settled as if settled now or of what they are likely to be settled at eventually.

One is concerned with underestimates of the effect of inflation, or of a quickening rate of inflation of claims on excess loss covers where the excess point is not fully index-linked (a matter involving inherent difficulty of analysis). The net overall effect is notoriously difficult to forecast. It has lead to what has been labelled by the Swiss Re as IBNER claims (Incurred but not enough reported).

If one is to discount, then it should be on an extremely conservative rate of interest, perhaps even a zero net real rate.

14.1.2. There are always all sorts of imponderable possibilities in the background: administrative weakness leading to failures to record claims, weaknesses and delays in communications, long delayed claims, exposures not realized, weakness of reinsurance security, unexpected accumulations of small losses, all possibilities that can largely be ignored when investment income can be expected to be available to cushion future reversals. If discounting is employed then the possibility of such imponderables arising also demands to be covered.

14.1.3. The actual settlement patterns of claims, particularly liability claims, can show wide variations from year to year. One decision in a Court case can give rise to a flow of settlements. The period for which claims will remain outstanding and during which the resultant funds will be available to generate investment income, is difficult to forecast with any degree of precision and hence once more a conservative approach is called for.

14.1.4. Taken all in all, an attempt to apply discounting will often result in a small or nil overall effect on the level of reserves to be set up. In a sense and to an extent we are already implicitly discounting by not taking an increasing rate of inflation and other imponderable factors into account.

14.2. When an office is factually insolvent there is no fund left, monies are being supplied by the owners to meet claims as they arise (which is currently happening in a number of cases) and the question of discounting cannot arise.

15. STRENGTH OF RESERVING

15.1. This paper has been restricted to the subject of the techniques that are available in calculating reserves. Apart from a few of the comments, it has not been concerned with the strength of reserves that should be set up, questions of rate of release of reserves or of solvency requirements. Those considerations are being considered in depth by a working party which reports to the Institute through papers from time to time and to more specialized groups such as Astin and the annual G.I.S.G. conference.

15.2. Of recent years the subject has been overshadowed by action of the Revenue, which is fully prepared to accept provisions against claim outstanding advices and IBNR but not of the retention of further amounts against possible future adverse trends. In particular, roll-over funds have come under direct attack.

On the other hand, the Revenue is aware of problems that arise in the London Market from late and inadequate reporting by cedants. In my experience a reasonably strong basis of reserving is unlikely to be objected to provided the basis is clearly defined and consistently applied.

15.3. Although every underwriter sets his exposure limit in terms of the reinsurance protection he has been able to purchase and will not wish to start a new underwriting season until the protections are in place, two very great difficulties exist in the reinsurance world:

(a) It is often by no means easy to determine with any degree of precision what is the limit of exposure underwritten on a treaty, worst of all being on LMX cover accepted.
(b) There may be a gap in the reinsurance protection which has not been spotted.

It is the normal policy in the London Market to write risks to high possible claim limits and then to reduce those limits to manageable proportions by means of reinsurance. With the very tight conditions now existing in the market, LMX protection is difficult to purchase and has become costly. The actuary examining the financial strength of the office will have to examine the structure of reinsurance protections in force. Reserves should not normally be a problem as major catastrophes or large losses begin to throw their shadows through the system fairly rapidly. The ripple effects can continue for some years.

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