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LIFE REINSURANCE

by

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The paper briefly traces the history of reinsurance and discusses the need for a reinsurance market. It compares the various needs with the coverages available and their application. The paper concludes by surveying the role of the Actuary.

HISTORY AND DEVELOPMENT

1.1. Seventeen years have passed since a paper was last submitted to the Institute of Actuaries Students' Society on life reinsurance (Steeds, 1953) although the Faculty of Actuaries Students' Society received a paper in 1963 (Wilkie). The classic full paper was presented to the Institute by Foster in 1946; honourable mention must also be made of Clough's paper to the Institute of Actuaries Students' Society in 1926. My indebtedness to the above is only surpassed by that to my office colleagues, but anything wanting in this paper is my sole responsibility and should be blamed on my want of ability and not my poor intentions.

1.2. Life reinsurance practice in this country can be traced as far back as the middle 19th century when some Scottish offices made an agreement concerning their acceptance of reinsurance of amounts surplus to each other's retentions. Retentions were relatively high in those days and during the years following this first reinsurance agreement, more attention came to be paid to both the fundamentals and the practice of reinsurance.

Original premium reinsurance was the rule, with the proviso that with profit business could be reinsured on a non-profit basis.

1900 saw a reassurance agreement signed by many offices defining the code of conduct and method of administration of reinsurances. An alternative to original premium reinsurance on the ceding company's rates was introduced - the reinsurance on reinsurers' standard rates for direct business. At this stage there were no professional reinsurers in today's sense – viz offices that transact reinsurance only and do no direct business whatsoever.

Professional reinsurers have existed in Europe for quite some time, almost all of these being associated with major direct writing companies.

In 1919 the first professional reinsurer entered the United Kingdom market but progress was relatively slow until after the Second World War. In 1958 a second professional reinsurer entered the market and recent years have seen a number of new entrants, (5 or 6), both United Kingdom based and associates of foreign based companies. The professional reinsurers as a whole are expanding far faster than the direct market in the United Kingdom. For the major United Kingdom companies this reflects the worldwide nature of their operations - more than 50% of their business being written overseas.

1.3. The early reinsurances were largely arranged on a facultative basis with freedom for the ceding company to offer, and complete freedom for the reinsurance company to accept/decline/rate up. Nowadays a very substantial volume of reinsurances written tend to be non-facultative in the sense that the reinsurer binds himself to accept the business if offered.

A second major development has been the trend towards risk premium reinsurance - where the reinsurer covers the mortality risk only, at his own terms - as opposed to the early reinsurances which were original premium with the reinsurer participating in all risks and profits, not only mortality but also interest, lapse, surrender etc. This is not to say that the volume of original premium reinsurances is not still very substantial!

A third development has been in the philosophy of reinsurance. No longer is the reinsurer solely the provider of capacity. He is in a strong position on account of his wide experience of impaired lives, different classes of business and different markets, to provide technical and administrative assistance and advice over a wide range of topics.

NEED FOR A REINSURANCE MARKET

2.1 A new company, and to a lesser extent established companies, have to face, among their other many problems, those of:

- How to protect their account against adverse mortality fluctuations,
- How to deal with impaired lives,
- How to mitigate the financing strain involved in the issue of permanent (as opposed to temporary) assurances.

2.2 The problem of adverse mortality fluctuations is not solely the risk of insolvency, there are the considerations that:

(a) to a degree the funds set up under any one class of policies should be regarded as only available to a limited extent as backing for the funds set up for any other class of policies.

(b) with profits policy holders, and perhaps also shareholders, have come to expect a distribution of profits: the company may wish to minimise the possibility of a reduction in this level of distribution due to adverse claims experience.

We may distinguish three types of protection:

Against catastrophes: the possibility that a single event may cause multiple claims - dealt with by Excess of Loss coverage.

Against an excessive number of claims in any one period - dealt with by Stop Loss coverage.

Against the possibility that while the mortality experience by number of claims is acceptable, the 'wrong' claims have occurred so that the experience by account is unsatisfactory.

Section 3 will consider the various techniques of reinsurance from a technical viewpoint, the question remaining, however, as to the markets in which to seek those covers. The mortality fluctuation protection cannot be considered independently of the problems of under-average lives and financing strains.

2.3 We may ask why the problem of the 'wrong' claims occurring should present any problem - could we not decide upon a maximum sum insured any one life and only accept proposals accordingly, i.e. issue limit = retention limit? If the company is able to show any profit on policies partially reinsured then that is reason enough, however even if there is a cost associated with accepting business which must be reinsured, there may still be reasons for writing and reinsuring:

(i) additional agency earnings - the field force are able to increase production and earn commissions on business which would otherwise be handled by competitors.

(ii) Growth - as a new company expands and takes decisions to increase its retention, it is helpful to have been reinsuring excesses, not only for insight into likely impact of retention limit increases, but also for guide to underwriting practices on larger risks qualifying for retention.

(iii) Recapture - if a recapture privilege is granted, the company is in a position to make retention increases retroactive in certain circumstances; this would not be possible if the business had not been accepted in the first place.

The assessment as to the actual cost of accepting business in excess of the retention limit and reinsuring the excess is by no means clear-cut and may be carried out in one of four ways according to the various assumptions made:

(a) That the company either retains or reinsures the business, (the results here may be very sensitive to small changes in underlying mortality, interest and lapse assumptions). This technique is appropriate when considering changes in retention limit or when comparing reinsurance proposals.

(b) That the company either does not issue, or reinsures, the amount in excess of its retention, (again very sensitive to small changes in underlying assumptions). This technique is appropriate when deciding to increase issue limits rather than retention limits, or when comparing reinsurance proposals.

(c) That the company either does not issue the entire policy or reinsures amounts in excess of its retention. Appropriate when company hampered in its operations by low issue limit, or when comparing reinsurance proposals.

(d) That the company may lose agents whose operations are particularly hampered by low issue limits caused by lack of reinsurance facilities. This is difficult to quantify.

Supposing that the decision is taken that the issue limit will exceed the retention limit, so that reinsurance coverage is required, the question arises as to where the coverage is to be sought.

2.4 Basically there are three possibilities: Exchange of business with other direct writing companies in the same territory; exchange of business with other direct writing companies in different territories; access to the professional reinsurance market.

Exchange of Business with other Direct Writing Companies in the same Territory

Pros
- Provided a network can be established, decisions will be rapidly obtained.
- Reciprocity is likely.

Cons
- Information given to competing offices.
- Sub-standard business may be hard to place.
- Danger of lack of capacity.
- Suitable staff must be trained/bought; there is also a drain on management resources.

Exchange of Business with other Direct Writing Companies in other Territory

Pros
- No information given to competitors.
- Plenty of capacity.
- Reciprocity – provided currencies offered acceptable.

Cons
- Decisions will be slower – and more expensive.
- Sub-standard business may be hard to place.
- Staff training, recruitment, management resource drain
- Little market for certain classes of business due to differing taxation, investment and legislative conditions in the countries of issue and reinsurance. A classic case in point is the difficulty of covering elsewhere on original premium with profits endowment policies written in the United Kingdom.

Access to The Professional Reinsurance Market

Pros
- Decisions very rapid
- Plenty of capacity
- No information given to competitors
- Costs will be lower
- Not necessary to train own staff
- Profit sharing likely to be possible.
- Certain other services will be available – see later

Cons
- Some drain on management resources – much less than the other methods
- Only limited reciprocity is likely – professional reinsurers cannot exist on 100% reciprocity!

2.5 Catastrophe and Stop Loss coverages may be analysed in the same way as to the most appropriate market. The arguments in favour of the third alternative, that of seeking coverage in the independent, professional reinsurance market, take on added force. What finally must clinch the decision is impaired life assessment and mitigation of financing strain. To the expertise that is offered by the

professional reinsurer in assessment of impaired lives, they would also add other services:

a) Training. It is accepted that part of a reassurer's service embraces the training of underwriters/life managers in both technical matters and office administration.

b) Marketing. The reassurer is prepared to advise usually in general terms on the nature of the markets, types of policy most suitable, proposal forms, etc. etc.

c) Actuarial Support. A certain degree of actuarial advice/support may be provided by the reinsurer in certain circumstances.

It is unlikely that a company could expect to receive such services from other direct writing companies! Of course, these services may be obtained from consultants – but only at a price. The reassurer reckons to provide such services and hopes to recoup his costs by receiving a certain amount of business – which he hopes will be profitable!

REINSURANCE COVERAGES

3.1. Having established the desirability of a professional reinsurance market, we must next consider how its members are to carry out their appointed tasks; we may recapitulate: mortality fluctuations, impaired lives, new business financing.

3.2. Mortality fluctuations

The protection here required is against the possibility that actual mortality experience departs significantly, in amount, from that provided for in premiums/valuation reserves. It is obvious that complete certitude can only be achieved by removing all sources of profit as well as risk, though it is true that some form of profit sharing may be negotiable, either as such or by means of the sale of a portfolio.

However, a certain fluctuation about the expected mortality result will be acceptable, as indeed will be a certain low, possibility of insolvency. Having taken the top management decisions as to: the acceptable fluctuation - ideally expressed as only an x% possibility of actual claims amount exceeding l00%+ of the expected - and the acceptable possibility of ultimate ruin, it will be necessary for management to obtain the necessary reinsurances as efficiently as possible.

Under the broad heading of efficiency we here include:

(i) The profit margin in premiums ceded.

(ii) Minimum additional expenditure incurred.

(iv) Minimum expenditure of management resources.

(iii) Maximum security and continuity of cover

(iv) Maximum flexibility of cover - bearing in mind that reinsurance needs will change, in particular with the added protection given by increases in size.

(v) Maximum feed-back benefits obtainable from reinsurers - not only the additional services mentioned in Section 2, but also such benefits as the ability to have a second underwriting opinion on difficult sub-standard cases and the many connections of reinsurers.

It has been shown that the optimum form of reinsurance protection under the assumption that it is the aim of the company to minimise the variance of expected claims is Stop Loss reinsurance. The theory that arrives at this result, however, does not take into account anything over and above pure net premiums. A premium charged for any risk consists basically of three elements: pure net risk, fluctuation, and expenses. The significant element in Stop Loss insurance rating is the fluctuation premium. A priori this must be so, as may be seen by considering the fact that a Stop Loss cover minimises the ceding companies' claims variance and hence maximises the reinsurers' claims variance.

However, there is little to be gained from such a mathematical approach and we must examine more closely the nature of the problem.

The company is concerned with protecting its life account against mortality fluctuations.

If we use the statutory definition, we are concerned with the long term insurance fund and it is this long term nature of the risk accepted by the life assurance market which has, inter alia, led to the development of the actuarial profession. More particularly it must be borne in mind when seeking reinsurance protection.

It is of the essence of catastrophe and Stop Loss coverages that they are only guaranteed renewable for a short number of years, if at all. As a result if the totality of the company's account is to be protected by means of catastrophe and Stop Loss coverages, the cost to the company may become so high that, in effect, no protection has been obtained.

Moreover, complete protection of a company's account would not be attractive to the reinsurer unless the premium was loaded very heavily for fluctuations, if then. I am not aware of any reinsurer that offers such protection.

This is not to say, however, that catastrophe and Stop Loss covers do not have a place in the protection of an account; they do have a role to play, but this role is only a small one.

3.3 Impaired Lives

Since the last war there has been a steady improvement in the prospects of an impaired life obtaining cover. Prior to that time the direct offices acted independently and any necessary reinsurances were dealt with facultatively between the offices - this required the respective Chief Medical Officers coming to an agreement. As a result of the relatively few examples of impairments experienced, the rate declinature was high and although terms were quoted on some sub-standard cases based on height/weight tables and blood pressure charts, it was relatively infrequent for any other impairments to be rated, or for a rating manual to exist.

Since the War the professional reinsurers have pioneered the way to rate a wide range of impairments and have gathered together with the experience of many companies to enable them to accept risks which the companies have initially felt it prudent not to.

This information and knowledge is now being imparted to the companies by the reinsurers and companies are now feeling able to rate and accept far more impairments as a result.

The classic piece of pioneering work was undertaken by one major professional reinsurer who researched experience of a large diabetic group (treated by Kings College Hospital, London) from diagnosis until death. This was followed by the establishment of a diabetic pool - under this participating offices had complete freedom whether or not to submit cases to the reinsurer for rating and acceptance. Specific premiums were debited to the companies and credited to the pool; similarly claims. Annual statements then resulted in appropriate credits of positive balances (or debits of negative balances), to the participating offices.

Similar pools were set up for blood pressure and coronary conditions. Overall, the pools have fulfilled their goals providing life cover and experience, while showing results which to date are believed to be not unsatisfactory. Nowadays the pools are less important - offices feeling able to rate and retain themselves. An

example of the progress achieved is for stabilised diabetics who were declined prior to the War but normal rates are now available for endowments for middle aged proposers with only a small insulin dosage.

Since the War one of the great contributions made by the reinsurers has been in the field of substandard underwriting. It is interesting indeed to speculate on the likely chance of acceptance, and if accepted the extra premium chargeable for some impaired lives today if the professional reinsurers had not involved themselves.

3.4 New Business Financing

One of the major problems faced by a new life company, or indeed any life company embarking on a programme of rapid expansion, is that of cash and valuation strains.

The reasons for these are familiar to us all - the relatively high commissions payable in the first year, together with all the set up costs, and the conflict between these and the customary use of a valuation basis which makes little or no allowance for the incidence of commission and expenses.

Naturally the problem is most acute for permanent policies (Endowments Whole Life, etc.) which may give rise to a situation as follows:

£l,000 25 Year Endowment, premium £3 per month

Premiums received		
7/l2ths x 36 =		£21
Commission at £2% =	£20	
Expenses =	£ 5	
Marketing =	£ 2.50	
Stamp =	£ 0.50	
		£28

Thus, a cash strain of £28 - £21 = £7 arises. It is further necessary to set up a valuation reserve, say 1%, i.e. £10.

The total valuation strain is thus £17, i.e. 1.7% of sum assured. If £20 million of new sums assured are written there will be a first year cash outflow of £140,000 resulting, after the establishment of a reserve of £200,000, in a total valuation strain of £340,000.

Similar, though not so spectacular, strains can result on temporary business, (Term Assurances, F.I.B., etc.).

Financing assistance is then required unless the company has adequate capital and free reserves to support the strain. To go to the market might not be either convenient, (shortage of monies at an affordable price), or acceptable, (perhaps some loss of control if equity diluted). A possibility is a reinsurance deal. This can take one of two forms:

(i) Modifying the commission terms between the company and reinsurer, e.g. for Term Insurances bearing front-end commissions of 30% initial, 20% renewal reinsuring either surplus, or more probably Quota Share on the basis of 120% initial, 10% renewal. We consider a 50% Quota Share of a 15 Year Term Policy for £10,000 at a rate of £0.30%

			£
	100%	To Reinsurer	Net Account
Premium	30	15	15
First Year Comm.	- 9	-18	+ 9
Expense	-10	--	-10
Reserve	-30	-15	-15
	-19	-18	- 1

If £50 million written, instead of a valuation strain of £95,000 we obtain a valuation strain of £5,000.

(ii) By using synergy: a direct writer in the United Kingdom is taxed on the basis of interest less expenses, and hence writes on the basis of net interest and net expenses.

The account of a professional reinsurer is becoming increasingly weighted by risk premium business. This business generates little investment and expenses far exceed this. Thus, the professional reinsurer has a tendency to be taxed on profits, thus writing on the basis of gross interest and gross expenses.

For permanent business much more favourable terms can be granted by an office on a gross-gross basis.

Thus a reinsurer in a gross position accepting coinsurance of permanent business can grant an overriding commission - our £1,000 Endowment, 50% Quota Shared might then attract a £4% initial commission by the reinsurer and look as follows:

	100%	To Reinsurer	Net Account
Income	21	10.5	10.5
Outgo	-28	-20.0	- 8.0
Cash	- 7	- 9.5	+ 2.5
Reserve	-10	- 5.0	- 5.0
Strain	-17	-14.5	- 2.5

If £20 million of gross sums assured written, £50,000 is available for investment and moreover total strain is reduced to .25% of gross sums assured, i.e. £50,000.

Plainly the amount of finance that can be provided in this way by the reinsurance market is limited by the constraint of remaining in a gross position, if by no other consideration.

It is interesting to note that the technique of coinsurance of term plans is very highly developed in the North American market but that since the initial reinsurance commission, (as quoted 120% compared with 30%) is obtained at the expense of under recovery on renewal commissions, (as quoted 10% compared with 20%), some direct writing life insurance companies operating such arrangements have been compelled by their insurance commissioners to set up reserves against the future under recoveries!

TTECHNIQUES OF REINSURANCE

4.1 As already touched upon in Section 2, the problem of mortality fluctuations may be analysed under three headings: catastrophe - lack of independence of events; Stop Loss - too many events; ‘variation' - the wrong events.

It is useful at this stage to draw the distinction between proportional and non-proportional covers. By proportional reinsurance we mean that when a claim arises on a policy, this claim is shared by ceding company and reinsurer in a proportion determined advance. The two commonest forms of proportional reinsurance are Surplus and Quota Share.

In ‘non-proportional reinsurance' the proportions of a claim falling to ceding company and reinsurer are not fixed in advance, and indeed it may not be possible to decide whether or not a single specified claim on the company gives rise to a claim on the reinsurer. For example, the Trustees of a Group Life Scheme may

calculate their expected claims in a year to amount to £400,000 and they require reinsurance (Stop Loss) on the basis that when actual claims exceed £500,000 (a priority level of 125%) the reinsurer will pay the excess. We consider below the series of possible results:

Claims	Retained by Trustees	Falling to Reinsurer	Percentage assumed by reinsurer
400,000	400,000	-	-
500,000	500,000	-	-
500,001	500,000	1	0.0002
550,000	500,000	50,000	9.0909
600,000	500,000	100,000	16.6667

Thus, the proportionate shares are not determined in advance and further it is not possible to apportion individual claims between Trustees and reinsurer.

4.2 Proportional Reinsurance Techniques

In appendix 1 we outline and discuss a few criteria which may be used for the determination of the companies' retention limits. To restrict the Sum at Risk to within these limits either Surplus or Quota reinsurance may be used.

4.2.1. (i) Surplus

Up to a certain size of policy the company retains the whole sum assured, but for policies in excess of this size the company reinsures the surplus only. Surplus reinsurance may be effected in two fundamentally different ways: original premium basis and risk premium basis.

Original Premium Basis

Here the reinsurer receives a proportion of the premium charged by the company and assumes a proportionate share of all liabilities, thus sharing in the profits or losses resulting from mortality, interest, expenses, as well as paid-up policies and surrender values.

Writing in 1929, Clough distinguishes two types of original premium reinsurance: 'pro rata' and, 'adjusted'. In the sense that 'adjusted' covers all original premium reinsurance where there is some distinction between the terms and conditions of the original policy and the reinsurance, virtually all original premium reinsurance is 'adjusted' today - even if only to the extent of an overriding commission being payable to the company. Among the relatively few

original premium reinsurances not carrying overrider are those with the most suicidal of the UK term insurance rates!

Risk Premium

Under this method of reinsurance the company reinsures the death risk only, retaining itself all reserves and hence all interest and expense profits as well as paid-up policies and surrender values. It is necessary to define the sum to be reinsured. There are three approaches:

a) Pro Rata: the company retains a constant percentage of the Sum at Risk (face sum less reserve), the reinsurer is thus on risk for the duration of the policy.

b) Top triangle: the company retains a constant amount of the Sum at Risk - the reinsured amount now decreased by the reserves under the entire policy and so the reinsurer will probably not remain on risk for the full duration of the policy.

c) Arbitrary: the initial sum to be reinsured is run off by agreed arbitrary decrements.

In Appendix 2 sample schedules are shown

We now consider some of the practical aspects of reinsurance.

(i) Level Term Assurances: It is customary to ignore any reserves built up and so for the reinsurance amount to remain constant. In the event that any guaranteed insurability benefits or similar options are granted, it is of course essential for the reinsurer to receive his due proportion of these on a coinsurance basis – both liability and premium. Family Income Benefits are treated as Decreasing Term Assurances by the agreement of a commutation basis to produce the sums assured.

(ii) Permanent Policies: It is necessary to agree upon a basis to determine the Sum at Risk. The actuarial valuation reserve may be used for convenience. However, other bases may also be adopted which simplify calculation as well as providing the company with protection more in line with their actual exposure.

The worst exposure for a company arises during the first two years. Under the customary published valuation bases, positive reserves are held at all durations, whereas a gross premium valuation may well show

negative reserves - indeed it has been argued that the policy can be regarded as an asset of the company at the shortest durations.

While I am not aware of any reinsurer covering an amount in excess of the face sum assured, it is relatively common practice to disregard reserves in the first year or even two years. If such an approach be adopted, then the run down of reinsurance sum assured thereafter is normally achieved by level annual decrements reaching zero in the policy year prior to maturity (for an Endowment).

(iii) Rates: Risk Premium rates are age specific and the premium to be charged is the product of the rate for the age at the commencement of reinsurance year and the sum reinsured for that year. We may distinguish between policy year and calendar year reinsurance.

Policy year reinsurance is the simplest, both in concept and administration - the reinsurance year coincides with the policy year and the rate and sum reinsured are defined at the policy renewal date.

It is customary nowadays for risk premium rates to vary by duration, (in addition to sex and age). In the United kingdom a one year selection discount of 50% is customary. Particularly in the North American market, selection discounts may extend for five or perhaps ten years.

The selection discount serves two purposes: not only to reflect more closely the actual mortality experience likely for medically select lives, but also to provide minimal reinsurance premium outgo for a company during the first year of the policy - this assists the company for both cash and valuation strain problems.

The alternative to policy year reinsurance is calendar year. Here all reinsurances are renewable on a fixed date independent of the actual front-end policy renewal date. The most frequent application of calendar year reinsurance is to deal with the reserving problem in a territory where both licensed and unlicensed reinsurers operate. For example, in South Africa the company cannot take credit for unexpired premiums or outstanding loss reserves held by a reinsurer unless the reinsurer is licensed. In this case the reinsurance year is frequently chosen to coincide with the financial year of the company and calendar year reinsurance affected. Thus, no outstanding premium reserve need be held in the books. The premium for the first period of reinsurance may then

be either a pro rata amount, (with subsequent periods affected by policy year selection discount), or a policy fee dependent on age to the extent of broad bands, the renewal rates being ultimate rather than a mixture of select and ultimate.

(iv) Sub-standard lives: the classical, and simple approach is to charge a multiple of the standard rate, depending upon the rating, e.g. + 150% attracts a risk premium rate of 2.5 x standard. However a number of professional reinsurers do determine premium rates per table – one table = plus 25% rating, thus + 150% is table 6.

(v) Experience Refunds (Profit Commission): it is customary that, when a portfolio of reinsurances is covered by a treaty, the treaty includes a provision for the periodic calculation of the profit that has emerged under the treaty and, provided that certain conditions are satisfied, for a percentage of this profit to be returned to the company. The method of calculation commonly used is shown below:

Item	Income	Item	Outgo
1	Reserves brought forward at start of period	3	Claims occurring in period (paid plus outstanding).
2	Premium due in period	4	Commissions, taxes etc.
		5	Reinsurer’s margin
		6	Reserve carry forward at end of period

Notes:

(a) Items 1 and 6 are commonly taken to be 50% of premiums due in last year of account for policy year reinsurance - this allows for the unexpired risk. For calendar year reinsurance no unexpired risk arises but in the event that the profit calculation is carried out shortly after the close of the account, it might be appropriate to include a reserve against incurred but not reported claims.

(b) Any adjustment in claim outgo, (e.g. outstanding claims subsequently denied, or late notification of claim), etc. causes a recalculation of the statement and settlement of the net difference, perhaps with an interest allocation.

(c) While the account is of course expressed in terms of premiums due, it is common practice to work on a premium accounted for basis. The difference is more significant in retrocession agreements than in reinsurance agreements as in the former case there is not only the delay before the ceding company advises the reinsurer of new business, lapses, etc., but also the delay before the reinsurer advises the retrocessionaire.

(d) Item 5, the reinsurer's margin, is in part an allowance for expenses incurred by the reinsurer, but is also an integral part of the whole package. Risk premium rates, reinsurer's margin and refund percentage are intimately related to each other and the underlying mortality rate expected. The reinsurer's margin is not commonly expressed as a simple percentage of premium in the United Kingdom, but more complicated formulae are used. These may provide for a mixture of a percentage of premium, rate per mille on sum insured, amount per case and reduction when certain levels of sum assured covered are exceeded.

A profit can only really be regarded as fully earned and available for distribution if the account is of such a size, and with such continuity, that there is a reasonable probability that expectation will be achieved. Clearly, if the expected number of claims in a period is less than unity either a profit or a large loss must occur and the reinsurer cannot afford to accept a substantial discount on his profits while, possibly, having to run his losses gross. A minimum number of cessions in force and new cessions in the period of account is usually made the condition of a refund. If the treaty has been cancelled for new business so that the portfolio under consideration is merely being run off till natural expiry, there is a great danger that the account may become less and less balanced in that the ratio - maximum sum insured/premium income - rises so that if a large loss occurs, insufficient profits may arise in the future to offset this loss. However, if profits occur throughout, profit commission is paid. Thus, the reinsurer may pay losses gross but receive profits net. For this reason, on cancellation of a treaty for new business, it is common practice for profit commission computations to cease. The loss of possible potential profit commission is one of the costs of fundamentally revising treaty arrangements - for example, a change of primary reinsurer. Any management must bear this consideration in mind along with all the others, when setting up reinsurance arrangements.

4.2.2. Quota Share

Under the Quota Share method of reinsurance, instead of the company keeping a retention on each and every life and reinsuring only the surplus, the company

decides to reinsure a fixed percentage of each and every case. This method results in the company giving away far more premium than it need since in order to reduce exposure on the largest policy to its retention, the exposure on all other policies must be reduced below that which would be retained under a surplus method of reinsurance. The great advantage of the method is its administrative convenience in that reinsurance records need no generation (other than copying original records). For this reason Quota Share reinsurance is normally carried out on an original premium basis modified only to provide for an overriding commission. To reinsure a Quota Share on a risk premium basis would be inconsistent in that to use the risk premium basis a reinsurance record must be generated which bears little immediate relationship to the original.

We may here digress to note that a block of surplus reinsurances from a company may be Quota Shared between a number of reinsurers. While a relatively uncommon method of covering the reinsurance needs of a direct writing company, it is rather more common when we come to the retrocession needs of a reinsurer.

It is sometimes the case that circumstances dictate the use of Quota Share reinsurance:

(a) When the total commitment that a company would undertake in a particular field is judged by the company to be excessive in relation to either the company's knowledge and experience of that field, or the funds supporting that field. The company may then choose to reduce its commitment. Having dealt with the peak risks by way of surplus reinsurance, the company may then decide that it does not wish to retain more than a certain quantum of premium. A simple and powerful technique is then provided by Quota Share reinsurance.

(b) When the company is insuring, for example, a Group Life Scheme by means of a flat rate premium, it would not normally be possible to reinsure on a surplus basis at that rate of premium since under the normal type of Group Life Scheme the level of benefit is highly correlated with age. Hence the normal form of protection under a flat rate Group Life Scheme is afforded by Quota Share reinsurance.

4.3. Stop Loss

Priority Level:	150% (basis A.49/52 ult.), minimum £300,000
Limit:	£200,000
Warranted:	Maximum sum any one life £50,000
Rate:	5% of expected claims, minimum and deposit premium £lO,000

Above is shown the typical conditions of a Stop Loss cover to provide that, if there are so many claims that the total amount paid exceeds 150% of expected, (150% priority level), with a minimum of £300,000 paid, then the reinsurer will pay the excess of this priority level up to a maximum reinsurance claim of £200,000.

Furthermore, since it is not the function of Stop Loss reinsurance to protect against the wrong claim occurring, a limit on the maximum claim, (£50,OOO) chargeable against the cover is necessary.

The rate chargeable is customarily expressed in terms of the expected claims but subject to a minimum premium in any event. This minimum premium is customarily deposited in advance.

The calculation of the pure net premium for a Stop Loss contract is a relatively minor problem in principle.

Provided that the lives under consideration are independent, then for n lives each with a probability of q of dying, the distribution of claims in any one year is of the binomial form. Provided n is large and q is small, the most useful approximation is afforded by the Poisson distribution. This is readily calculable.

If nq is relatively large, the Poisson distribution becomes less accurate and the normal distribution is more appropriate, the standard deviation being:

$$\sqrt{npq}$$

To transfer this theory to the practical situation is, however, less easy. If it assumed that every policy is assured for the average, then the net premium required is again easily calculable.

However, some policies will be appreciably larger than the average so the above approach understates the cost. An over-statement of the cost may be obtained by dividing the total sums assured by the maximum thereby providing a smaller number of (notional) lives. The true net premium then falls between these limits.

Naturally, if a computer is available to do the necessary simulation work, the above approximate techniques are not necessary.

It is not probably correct to regard the lives as fully independent. The most probable causes of occurrence of Stop Loss claims, which tend to be very infrequent, are hard winters, epidemics, natural disasters and particularly in respect of Group Life Schemes, accidents causing multiple loss of life.

In addition the low probability of a Stop Loss claim coupled with the small number of Stop Loss contracts written by any office has the result that we cannot hope to achieve a balance of premiums and claims in any one year. The same problem would arise for a company only insuring a handful of lives - for a well established office with a large portfolio the number of lives is so great there is a reasonable probability of expectation being achieved and the standard deviation of that expectation is relatively small. The standard deviation of the expectation under a relatively small Stop Loss portfolio is large and as a result a very large contingency margin must be built into the Stop Loss premiums.

A suitable loading is probably proportionate to the squareroot of the pure net premium. The impact of this may be assessed by considering the comparable case of a large life portfolio where expected claims might be as high as 1,600, the squareroot of which 40, is 2.5% of expected. Under a Stop Loss portfolio with a total expected number of claims of .04, the squareroot of which, 0.2, is 500% of expected.

4.4. Excess of Loss

The intention here is to cover the company against any one catastrophic event causing losses in excess of a specified figure.

This is one of those covers where the events that can give rise to a claim must be very carefully defined. In view of the 'any one event' requirement it is necessary to exclude epidemics and the following are among the likely exclusions among accidents: war and civil war, atomic risks.

Furthermore, certain classes of assurance will be excluded, namely: airline personnel, professional sports teams, airport coupon and ticket business, travel agency business, permanent health insurance business, credit card business, and Stop Loss or Excess of Loss business accepted.

Dr. Strickler has fitted the function:

$$A(x) = 8x^{\frac{-1}{3}}100^{\frac{1}{x}}$$

A(x), the number of deaths per year for each million of population resulting from accidents claiming x or more lives.

The coverage granted will specify the minimum number of claims which must occur before a reinsurance claim is payable, also the minimum claim amount payable before a reinsurance claim is payable. The maximum amount of reinsurance claim possible would also be stipulated. The rates quoted would be as a rate per mille on the sums covered by the company. A maximum sum insured any one life would also be specified. The premium chargeable will, as with the Stop Loss premium, depend upon both the average sum assured per life and the relationship of this to the maximum sum insured on any one life.

Similarly to the Stop Loss cover, a loading is necessary as any one company's portfolio will contain only a few risks each with a low claims probability. This loading is again likely to be proportionate to the standard deviation of the pure net premium.

This cover is a very useful one. Unlike the Stop Loss cover it is as important to a large office as a small one since for a large office the number of lives covered is sufficiently large for the variance of the number of claims to be relatively low, and hence the need the stop Loss coverage negligible, whereas the greater number of lives increases the probability of accumulations in any one accident thus maintaining the need for a relatively cheap Excess of Loss protection.

REINSURANCE RELATIONSHIPS

5.1. Facultative:

Under the facultative method of reinsurance the company has complete freedom as to where to offer a case. Full underwriting papers are provided and the reinsurer has full discretion to accept or decline or ask for additional medical evidence. Furthermore, the reinsurer may ask for whatever extra premium he thinks necessary. Reinsurance cessions may be effected either on original premium terms or risk premium.

The professional reinsurers have developed considerably the skills of underwriting sub-standard lives and placing very large sums insured whilst maintaining a very rapid service - on the bulk of sub-standard risks it should be possible to receive a decision within a matter of hours from one's reinsurer, while a large standard or only marginally sub-standard risk without a substantial amount of insurance

already can be covered for an amount of up to £1 million within a few days. Thus, the offering of facultative reinsurances involves little or no delay in issuing acceptance to the agents, while the company can rapidly learn from its experience.

However, for a small/new company the labour and inconvenience of submitting to at least one reinsurer every single policy exceeding the retention limit - and for a very new office this might well mean a very substantial proportion of all new policies – makes this non viable. Some simplification and speeding up of the process is necessary even though thereby a certain amount of flexibility is lost.

5.2 Treaty:
One of the major developments in the reinsurance market has been the growth and sophistication of the automatic reinsurance treaty.

Under an Automatic First Surplus Reinsurance Treaty the company must offer and the reinsurer must accept all business belonging to certain classes defined in the treaty which exceed the company's retention, up to a certain limit - the binding limit. Where for reasons of age or degree of sub-standard mortality, the company keeps a lower, retention on some cases, the treaty limit is reduced proportionately.

An actual Reinsurance Treaty is very much concerned with administration as well as the fundamental principles of the relationship, the following subjects are typically covered:

(i) Classes of Business – may include all business accepted by the company, or may be restricted to a particular class. A distinction may also be made between standard and sub-standard business.

(ii) The retention schedule of the company and the capacity of the treaty.

(iii) Automatic nature of treaty: company bound to offer and reinsurer bound to accept business falling within the terms of the treaty.

(iv) Scales of premiums and commissions applicable.

(v) Documentation of reinsurance - each cession is associated with a Definite Certificate prepared in duplicate, signed by both parties and one copy retained by each. The Certificate gives details of the cession and may be accompanied by copies of proposal papers and medical evidence - the latter are particularly infrequent nowadays since no reinsurer would give

binding authority to a company unless it was completely satisfied with the quality of underwriting - although the reinsurer must periodically satisfy himself on this point, and in particular any changes in the underwriting team or the management of the company that may result in a change in underwriting philosophy or policy.

(vi) The methods of dealing with all alterations - lapses, surrenders, paid-ups, revivals and non-forfeitures - as well as new business and renewal advices and account rendering and settlement. Accounts are customarily rendered quarterly in arrears.

(vii) Claims administration - copy papers are always received by the reinsurer and settlement is customarily made in account. However, the company would have the option to request cash settlement of claims exceeding an agreed figure.

(viii) Arbitration procedures and errors and omission provisions.

(ix) Cancellation - it is normal practice for cancellation in respect of new business to be available to either party at three months' notice, however existing business will continue until the natural expiry of front-end policy.

Under normal circumstances the reinsurer's liability starts and finishes concurrently with the company's, notwithstanding the 1900 Reassurance Agreement neither side has the option to discontinue reinsurances.

(x) It is normally provided that any business falling outside the automatic limit of the treaty may be offered (and correspondingly may or may not be accepted) to the reinsurer in that, on acceptance, the policy falls under the conditions of the treaty.

(xi) Profit Commission: the computation technique and the necessary conditions that must be satisfied before a payment is made have been covered in 4.2.1. If all business ceded, whether automatic or facultative, is included in the profit commission computation, there is a great risk that if one of the large facultative cases becomes a claim the profit commission account may be soured for years and years to come. It is customary therefore to put a limit on the size of the maximum cession participating in profit commission; this is frequently made equal to the treaty limit.

5.3. Non-fully Automatic Treaties:

There is a third class of agreement falling between the extremes of automatic and facultative. This is the facultative/obligatory agreement and under this agreement the company may offer, but the reinsurer is bound to accept business falling within the terms of the treaty.

A major disadvantage of the facultative/obligatory treaty is seen when a premature loss occurs, (a policy becomes a claim after acceptance by the company but before advice received by reinsurers). Under an automatic treaty there is no doubt as to the liability attaching - the cession amount is fully defined by the treaty. If, however, there are a number of facultative/ obligatory treaties then the procedure is less clear. It is customary to first carry out all prior charge reinsurance, and then to allocate what remains of the claim among the facultative/obligatory reinsurers - perhaps in proportion to the last year's reinsurance premium ceded, but in any event not exceeding the treaty limit.

This premature loss drawback to the use of facultative/obligatory covers is less material if a company's first surplus needs are met by an automatic treaty, the facultative/obligatory covers coming in afterwards since the number of cases falling under these arrangements is now relatively few and control is simpler.

It may be useful to deal with a purely facultative reinsurance relationship by a treaty: in this case the treaty would solely define the administration procedures.

5.4. Reciprocity:

In those, one is told, more leisurely days before the Second War, and before the concept of the professional reinsurer had been sold to, and accepted by, the direct writing British companies, such reinsurance as was necessary was dealt with on a facultative basis between direct writing companies who aimed at approximate reciprocity using a register for control purposes. A few days’ delay while agreement was reached counted for less then now.

Since the War the twin developments of the professional reinsurance market and the number of very large policies, have caused direct writing companies to pursue the goal of reciprocity with less vigour than the goal of capacity. Even with the substantial group retentions of today in both the direct writing and reinsurance markets, a considerable volume of retrocession business becomes available, but this is perhaps traded between the reinsurers themselves rather than back into the direct writing market.

One can find a number of reasons for this, for example:

(a) The classes of business and currencies acceptable to the British direct market will not anything like cover the retrocession needs of the professional reinsurer operating on a world-wide basis - with very likely well over half his business arising outside the United Kingdom.

(b) The reinsurance market cannot exist by reciprocity alone and indeed has developed more in the direction of providing ceding companies with professional and personal services (in addition to capacity) than with providing reciprocity.

5.5. Overseas:

There is of course a tendency for the reinsurance markets to flourish in a territory with a strong direct writing market. In Europe and lately in North America, there has been a much greater development of the reinsurance market than in the United Kingdom. Their association with direct writing companies has provided the large European reinsurers with a basic reinsurance portfolio, giving them a strong position to deal with the reinsurance needs generated by relatively low retentions by U.K. standards. In the North American market the emphasis on insurance as a coverage as opposed to an investment vehicle, (as in the U.K.) has resulted in relatively high sums assured and consequently great reinsurance needs.

It may, of course, be part of a reinsurance deal that coinsurance with deposited reserves occurs in order to provide financing assistance to a small company: however, it is also frequently legislated that a company must set up reserves for its gross business thus forcing the depositing of reserves by reinsurers.

A major problem for the reinsurer who deposits reserves is the form of the deposit: if in approved securities, then the selection and maintenance problems must be faced; if in cash with the company, then the rate of interest allowed is commonly well below market rates. Against this latter problem may be set the greater ease of assessment of the value of the business since there is a guaranteed rate of interest.

In addition to these problems and transacting overseas business the reinsurer must also consider the taxes arising. Local premium taxes will be charged either directly, (if reinsurer liable), or indirectly (by way of an overriding commission if reinsurer not himself directly liable), and in addition, if no foreign life fund has been set up by the reinsurer, a further tax charge may arise in Britain if the reinsurer is taxable on the basis of interest less expenses.

For the above reasons, risk premium reinsurance may be more attractive to the reinsurer than original premium reinsurance - and indeed to the company if no financing is required. However, the difficulties in assessing the appropriate levels of risk premium rates to be charged until some experience is available must not be underestimated.

THE ROLE OF THE ACTUARY

5.6. The central characters on the reinsurance stage are the Underwriter and Actuary. The relationship between them must be very close and the assistance which the Actuary can give the Underwriter reflects the major role of the Actuary in reinsurance - this has perhaps greater similarity with the role of the Actuary in consulting practice than with the role of the Actuary in a direct life office.

The traditional role of the Actuary of interpreting the functions and operations of life insurance in a country against the background of the taxation, investment, legislation and socio-economic conditions, is compounded by the need for the reinsurer to understand, for each ceding company - but particularly for the small new company - the reinsurance needs both in the fields of the appropriate reinsurance techniques and relationships, and the precise nature of the products involved.

In the United Kingdom a new company will either have its own Actuary or have appointed consultants, so that the amount of purely actuarial advice which the reinsurance Actuary is called upon to give, is limited. However, the reinsurance Actuary is frequently called upon to work exceedingly closely with the company in order to determine the precise reinsurance needs of the company and the most appropriate methods of meeting them. To do this it is most important that the reinsurance Actuary is involved at an early stage in analysing the company's products and, if the company proposes to use a computer based system for the generation of reinsurance information, to be involved in the appropriate form which the output should take.

The position is quite different in the vast majority of other countries - it has been known for the reinsurance Actuary to be regarded as, if not actually appointed to the post of, Consulting Actuary to a small overseas company. The knowledge and background of the reinsurance Actuary may fit him well to this role but it is as well to be aware of two major drawbacks his company's position as

reinsurer may cause a conflict of interests over such matters as retention limits and negotiation of reinsurance terms and conditions; if his company also acts as a reinsurer of another company operating in the same market, the position may be rendered particularly delicate.

APPENDIX 1 - RETENTION CRITERIA

(1) We are concerned to limit the possibilities of insolvency and fluctuations in actual minus expected claim amount to 'acceptable' levels.

(2) We are further concerned to maximise either retained sums assured, retained premiums, or expected profit.

(3) Assuming that the insolvency criterion has been dealt with, we are concerned with limiting the possibility that actual claims C exceed expected claims E by more than X to a probability p.

If portfolio contained n lives sums assured

s_r r = 1, 2, ..., n

Let q_x corresponding to s_r be q_r

Then variance of C is V = $\sum p_r q_r s_r^2$

and E = $\sum q_r s_r$

If the number of policies is large, the central limit thereon will apply so that C will be normally distributed with mean E and variance V so that pr{C>V+X} is readily calculable in theory.

In practice, for a large account V will not be readily calculable while for a relatively small account the central limit approximation will be less useful.

If, however, the account is large and V is calculable, then if the criterion pr{C>E+X}<p is satisfied for a variance of V', new business written must be such that V + new issued variance is less than V'.

(4) If account is relatively small a better approximation may be afforded by the Poisson distribution and the following approach may throw additional light on the problem: if the sums assured are ordered then if a retention increase from R to S is considered with ℓ policies reassured when the retention is R, we may say approximately that these ℓ policies will now be retained for an amount S.

Using the Poisson distribution we may say that, if x = number of claims on these ℓ policies,

$$\Pr\{x = r\} = \frac{m^r}{r!}e^{-m}$$ m = expected claims = ql = $\sum q_r s_r$

and so probability actual claim amount exceeds expected claim amount by any given sum may be readily calculated.

The increase in net account sum assured is ℓ(S-R) and this benefit may be compared with the fluctuation increase for the extra line retained.

(5) We consider a portfolio of 100 cases each with sum assured £10,000. If q = 1%

	Probability			£5,000 per Life Claim amount	£10,000 per claim
X = 0	.3679	x <=0	.3679	0	0
1	.3679	1	.7358	5,000	10,000
2	.1840	2	.9198	10,0000	20,000
3	.0613	3	.9811	15,000	30,000
4	.0153	4	.9964	20,000	40,000
5	.0030	5	.9994	25,000	50,000
6	.0005	6	.9999	30,000	60,000

If £5,000 retained on each life, the expected claim amount is £5,000 and from the above table it may be seen that there is a 1% chance that actual claims are £20,000 or more, i.e. £15,000 more than expected.

With a £10,000 retention, expected claim amount is £10,000 and there is a 1% chance that the actual claim amount is £40,000 or more, i.e. £30,000 more than expected.

Thus, if there is to be at most a 1% chance that the account will not produce a loss, free reserves of £15,000 are required for a £5,000 retention; £30,000 free reserves are required for a retention of £10,000 per life.

We may generalise this result in a number of ways, perhaps the most constructive is that if the retention is to be increased by £X, free

reserves must rise by three times £X for there to be only a 1% chance of transfers being affected.

(6) The above model is of a very simple ‘rectangular’ portfolio. In general the portfolio will have a distribution of sums insured up to a number at the retention limit.

If the level of free reserves necessary to support mortality fluctuations on this portfolio has been established and 100 lives are currently covered at the retention limit, then any increase of the retention limit will require an increase in free reserves of 3 X this amount.

APPENDIX 2 - SAMPLE RISK PREMIUM SCHEDULES

We consider a twenty year Endowment on a male aged 35. The valuation basis used for the determination of the reserve is A.49/52 ultimate at 4%, and the basis used for the risk premium is,

$$\frac{v^{\frac{1}{2}}q_x + .5}{.95}$$ A.49/52 ult. 4%

Not only should the premium basis be regarded as purely hypothetical, but also it must be borne in mind that the reinsurer is unlikely to quote identical terms and conditions for the two methods of reinsurance.

We consider a £2,000 policy issued by a company with a £1,000 retention:
A Pro rata run down
B Top triangle run down

Policy Year	Age	Risk Premium Rate	Reserve	A At risk	B At risk	A Reass. premium	B Reass. Premium
		%	£	£	£	£	£
1	35	.19	16	984	968	0.94	0.92
2	36	.19	54	946	892	1.80	1.69
3	37	.20	92	908	816	1.82	1.63
4	38	.21	132	868	736	1.82	1.55
5	39	.23	174	826	652	1.90	1.50
6	40	.15	217	783	566	1.96	1.42
7	41	.27	261	739	478	2.00	1.29
8	42	.29	307	693	386	2.01	1.12
9	43	.32	354	646	292	2.07	0.93

10	44	.35	403	597	194	2.09	0.68
11	45	.39	453	547	94	2.13	0.37
12	46	.43	506	494	-	2.12	-
13	47	.48	560	440	-	2.11	-
14	48	.54	616	384	-	2.07	-
15	49	.60	674	326	-	1.96	-
16	50	.67	734	266	-	1.78	-
17	51	.74	796	204	-	1.51	-
18	52	.83	861	139	-	1.15	-
19	53	.92	929	71	-	0.65	-
20	54	1.02	1000	-	-	-	-

The reserve basis is:

$$1000_{t^{v}x:\overline{n}|} - 20(1 - _{t^{v}x:\overline{n}|})$$

A 50% selection discount has been allowed in the first policy year.

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