CASUALTY ACTUARIAL SOCIETY FORUM

Fall 1991 Edition

CASUALTY ACTUARIAL SOCIETY
ORGANIZED 1914

CASUALTY ACTUARIAL SOCIETY

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Date: October 1991

To: CAS Membership

Re: **The Forum - Fall 1991 Issue**

Dear CAS Members:

The Fall issue of *The Forum* is once again a substantial tome presenting papers which, for the first time, include articles by authors from the General Insurance Study Group (formerly known as GIRO) in the United Kingdom. Two of these papers discuss aspects of reinsurance and the London markets. Thanks to the efforts of Charles Hachemeister, we are able to offer several of these papers to our readers in this issue.

Other contributions to this issue include papers based on presentations given at the March 1991 Ratemaking Seminar and at the April 1991 Rate of Return Seminar. Other papers cover topics such as the development of pricing models, experience rating, and the regulation of insurance.

We hope that our readers will consider contributing their articles, papers, or drafts of papers to *The Forum*. The deadline for the next issue is December 31, 1991.

Yours very truly,

Irene K. Bass

Irene K. Bass
Vice President - Continuing Education

THE FORUM
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CAS Committee on Financial Analysis

The "C Risk" System of Categorizing Risks and Its Possible Applicability to the Property and Casualty Industry

The purpose of this paper is to briefly describe a system of categorizing the risks to which an insurance company is exposed. The categories have become widely accepted in the life insurance industry. It is not the purpose of this paper to recommend that this system be applied to the property and casualty industry. The purpose is to make casualty actuaries aware of the existence and wide acceptance of these categories. This system should be of interest to casualty actuaries because an enumeration of the risks to which a company is exposed can lead to an increased awareness of risk, sounder business decisions and a better managed company.

Also, as a risk categorization system becomes more widely known, there may be a tendency on the part of regulators, rating agencies, creditors, and investors to extend these principles to the property and casualty industry. Consequently, it is critical that any system categorizing risk endorsed by the CAS has proven usefulness to the property & casualty industry.

It is hoped that this paper will stimulate interest by casualty actuaries in creating a system of categorizing risk that is appropriate to the property & casualty industry.

Also, whether or not the risk categorization system used in life insurance is applicable to property and casualty business, there may be technical research by life actuaries which has a bearing on property and casualty issues. The paper therefore builds a bridge to life insurance research on risk theory.

Background

The Society of Actuaries Committee on Valuation and Related Problems has been studying the problem of how much surplus is adequate to cover the risks to which a life and health insurer is exposed. This problem has not yet been solved. Although this paper makes no attempt to quantify any of the risks to which a company is exposed, the interested reader can see reference [1] for an example of how one company quantified the risks. The above SOA Committee considered several general contingencies for which it is appropriate to hold a contingency reserve (see references [2] and [3]). The contingencies have become known as the "C risks" and are briefly described below.

C-1: Asset Depreciation Risk

C-1 risk is the risk due to changes in the statement value of assets because of the possible default of fixed income investments, changes in market value of common stocks or real estate, or the physical destruction of property (such as the property used as security for a mortgage). Changes in the value of assets due solely to changes in interest rates are not considered part of C-1 risk. The amount of C-1 risk depends on the credit quality of the assets and the mix of the assets, among other things. C-1 risk seems to apply to any company with invested assets. Therefore, C-1 risk seems to apply to property and casualty companies.

C-2: Pricing/Underwriting Risk

C-2 risk is the risk that actual premiums or losses will differ from projected premiums or losses needed to generate a targeted rate of return. For property and casualty companies this might include the possibilities that expenses, claim frequencies, claim severities, or claims arising from catastrophes will differ from what is anticipated in setting rates. Pricing risk has received considerable attention from casualty actuaries (see, for example, [4] and [5]).

C-3: Interest Rate Change Risk

C-3 is the risk associated with fluctuating interest rates. C-3 risk includes the reduction/gain in value of fixed income investments if interest rates rise/fall and the losses or gains due to a change in interest rates when assets and liabilities are mismatched. C-3 risk is most serious for companies writing interest-sensitive products such as guaranteed investment contracts and single premium deferred annuities, but the risk is also an important consideration for property and casualty companies. C-3 risk has begun to receive attention in the casualty literature (see [6], [7], [8], and [9]).

C-4: General Contingency Risk

C-4 risk is the risk associated with external events, environmental factors, fraud, management incompetence or bad business decisions. New legislation and regulations also belong in this category.

Discussion

If one develops a categorization of risks for property and casualty insurers, it is critical to appreciate the dissimilarities between property and casualty and life insurance writers. Sources of risk for property and casualty insurers can be investigated and enumerated. However, it is not clear at this time that such risks can be forced into the C risk scheme developed by life insurance actuaries. Under-reserving is a source of a risk to which property and casualty insurers are more exposed than life insurers and under-reserving is not easily placed into the C risk categories. Bond callability and recoverable reinsurance are sources of risks to which both life and property and casualty insurers are exposed that are also not easily categorized.

After much discussion, the Committee did not find the C risk categories particularly elucidating although they are relevant. The Committee may or may not be able to find in its future deliberations useful aggregations or categories of such risks. Such aggregations may not be useful for the way the industry currently maintains its accounts (for example, carrying bonds at amortized cost); and further modification to any categorization scheme will likely be necessary, if different accounting procedures are used.

Conclusion

This paper does not argue that property and casualty industry should adopt the C risk system or any convention of categorizing risks to which an insurer is exposed. It is, however, important that we recognize specific risks and problems. It is less important that we force the industry's risks into general categories of risk. It is not clear whether Proposition 103 is a C-2 or C-4 risk, but no company doing business in California can ignore the effects of Proposition 103.

Enumerating the specific risks to which a company is exposed leads to an increased awareness of the nature of the insurance business, and an aggregation of those risks may clarify that awareness further. It is worthwhile for casualty actuaries to research, define, and quantify the types of risks most significant to the property and casualty industry and to possibly develop broad categories of such risks to aid in the understanding of the insurance process.

Members of the Committee on Financial Analysis

Paul Braithwaite	Patrick Grannan
John Coffin	Orin Linden
Robert Deutsch	James Noyce
Myran Dye	Steven Petlick
Robert Eramo	William Roland
Owen Gleison	James Yow

1706F

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1706F

A STATISTICAL NOTE ON TREND FACTORS: THE MEANING OF "R-SQUARED" (CASUALTY ACTUARIES OF THE NORTHWEST, 3/89)

D. Lee Barclay

A STATISTICAL NOTE ON TREND FACTORS: THE MEANING OF "R-SQUARED"

D. Lee Barclay

Regression models have become standard actuarial tools for analyzing trends in frequency, severity, pure premium, reserves, development factors, and so on. Such analysis often is the basis for estimating future values of these random variables as an important aspect of ratemaking and reserving.

Since the inflationary spiral of the 1970s, the exponential curve has replaced the straight line as the regression model of choice. The exponential model is now commonly accepted even by regulators. By fitting an exponential curve, we actuaries can avoid the underestimation of losses that often results from the decreasing rate of change that is characteristic of the linear regression model. However, linear and other polynomial regression models are still used in some situations. Occasionally, other families of curves, such as logarithmic curves or power curves, are suggested as appropriate models.

In most cases, the purpose of the regression model is to obtain a "trend factor" that accurately reflects what has happened and/or will happen during the time period that interests us. In the linear model, the trend "factor" is a constant amount of increase or decrease per year. When we fit an exponential curve, we look for a constant percentage of annual increase or decrease.

Our models yield several tools that are useful for checking the validity of the trend factor. It is worthwhile to consider the magnitude of the residuals (mean squared error, for example) and whether the residuals show any discernible patterns over time. But the statistic that is used most often is the coefficient of determination, commonly called "R-squared." In imprecise terms, the coefficient of determination is the proportion of the data's variability over time that is explained by the fitted curve. But we often use this statistic as a measure of how well our model fits the data. If the coefficient of determination is high (near one), we are happy and our job is done. If it is low (near zero), we consider the model--or perhaps the data--nearly useless, and we look around for something else that will serve the same purpose.

A quotation from an actuarial software manual illustrates this common view: "This statistic [R-squared] indicates how good the fit of the line or curve is to the data points. A zero R-squared implies a poor fit of the line or curve to the data. . . ." And a large insurer has used the coefficient of determination as the maximum credibility it would assign to a trend factor.

Unfortunately, the coefficient of determination, by itself, is a poor measure of goodness-of-fit.

<u>Low R-Squared/Good Fit</u>

Consider this example, using the linear model for simplicity. Example 1 shows "data" for 10 years. The datum for each year is an independent observation from the normal distribution with mean 50 and variance 1. One would not expect to see a significant trend in these data, and, indeed, the slope of the fitted line is near zero. Although we can see from the residuals that the line fits pretty well, the coefficient of determination is only .024. (Note: Graphs of all examples are appended following the text.)

Example 1

Linear Model
Distribution: Normal(50,1)

Year	Data	Fitted Line	Residual
1979	48.746	49.425	-0.679
1980	49.914	49.461	0.453
1981	49.246	49.498	-0.252
1982	50.297	49.535	0.762
1983	48.455	49.571	-1.116
1984	50.088	49.608	0.480
1985	50.559	49.645	0.914
1986	50.173	49.681	0.492
1987	49.336	49.718	-0.382
1988	49.084	49.755	-0.671
Slope			0.037
Coefficient of determination			0.024
Mean squared error			0.446

In Example 2, we have introduced a positive trend into the same sample by adding one to the second point, two to the third, etc. (Clearly, this is equivalent to taking the first year's datum from Normal(50,1), the second year's from Normal(51,1), and so on. However, we are avoiding the random differences that would result from using data that are independent from those of Example 1.) We would expect the slope of the fitted line in Example 2 to be near one. It is; in fact, it is exactly one plus the slope in Example 1. The coefficient of determination for Example 2 is .952. But as the residuals are identical to those in the first example, we cannot say that this line fits any better.

Example 2

Linear Model
Distribution: Normal(Year-1929,1)

Year	Data	Fitted Line	Residual
1979	48.746	49.425	-0.679
1980	50.914	50.461	0.453
1981	51.246	51.498	-0.252
1982	53.297	52.535	0.762
1983	52.455	53.571	-1.116
1984	55.088	54.608	0.480
1985	56.559	55.645	0.914
1986	57.173	56.681	0.492
1987	57.336	57.718	-0.382
1988	58.084	58.755	-0.671

Slope	1.037
Coefficient of determination	0.952
Mean squared error	0.446

We could analyze these examples in terms of the equations that are found in basic texts on regression techniques, but it may be more helpful to discuss them less precisely. Both examples have the same amount of random error (also known as "white noise"). A curve that fits the data well explains everything but the random error. In both examples, the straight lines do that pretty well, but in the first one, there is little systematic variation ("trend") to be explained. The actuary should be concerned not with the proportion of the data's variation that is explained but with the magnitude of what is left unexplained. (Note that "magnitude" is still a relative term here; we might view the situation differently if the data in our examples began at five instead of at 50.)

Certainly one could construct counterexamples, but the general rule is this: When the fitted line or curve is steep, the coefficient of determination tends to be large; when the fitted line or curve is nearly flat, the coefficient of determination is likely to be small. But this does not imply that the steep line or curve fits the "steep data" any better than the nearly horizontal line or curve fits the "flat data." And, in particular, the low coefficient of determination does not imply that the relatively flat line or curve fits the data poorly.

High R-Squared/Poor Fit

Another example will show that a high coefficient of determination does not necessarily mean that the selected curve fits the data well. During the 1980s, the rate of inflation decreased substantially. For many lines of insurance, severity and pure premium data for these years reflect this decreasing rate. Still, the exponential model, which assumes a constant annual percentage change, prevails in most actuarial trend calculations.

This presents a problem. The exponential curve has a convex shape. But with inflation decreasing, the data points are likely to follow a curve with a concave shape. Example 3 shows the fitting of an exponential curve to "data" that follow a concave power curve. (The "data" are not random here, as the presence of white noise could obscure what is happening.) Even though the exponential curve is the wrong shape, the coefficient of determination is rather high at .946. This fact could easily tempt an actuary to use the exponential curve's trend factor, which is 9.3% per year.

Example 3

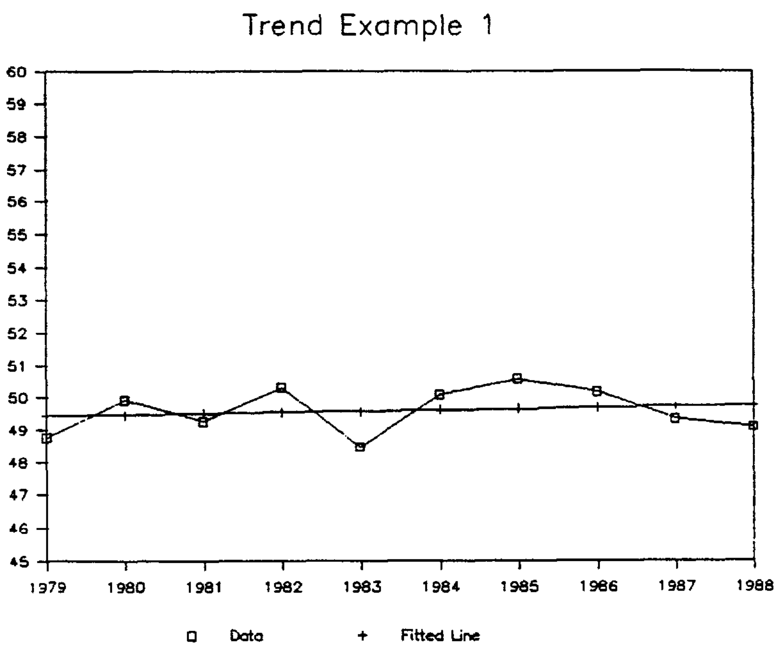
Exponential Model
"Data" = 25 + SQRT(Year-1977)

Year	Data	Fitted Curve	Residual
1979	35.355	40.174	-4.819
1980	43.301	43.916	-0.615
1981	50.000	48.007	1.993
1982	55.902	52.478	3.423
1983	61.237	57.367	3.871
1984	66.144	62.710	3.434
1985	70.711	68.551	2.160
1986	75.000	74.936	0.064
1987	79.057	81.916	-2.859
1988	82.916	89.546	-6.631
Slope percentage			9.314
Coefficient of determination			0.946
Mean squared error			12.287

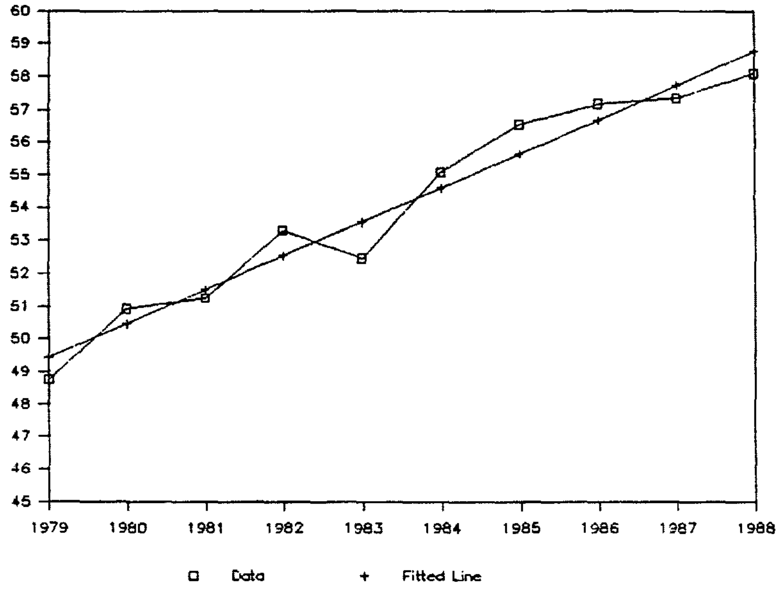
The potential for overestimation is significant. If, for instance, these data—for 1979 through 1988—were used in ratemaking, the trend problem might involve making an estimate for 1990. The fitted exponential curve hits 107.0 in 1990, whereas the power curve is at 90.1. Use of the 1990 value from the fitted curve would result in an error of 18.7%. But nowhere between 1979 and 1988 is the difference between curves so large.

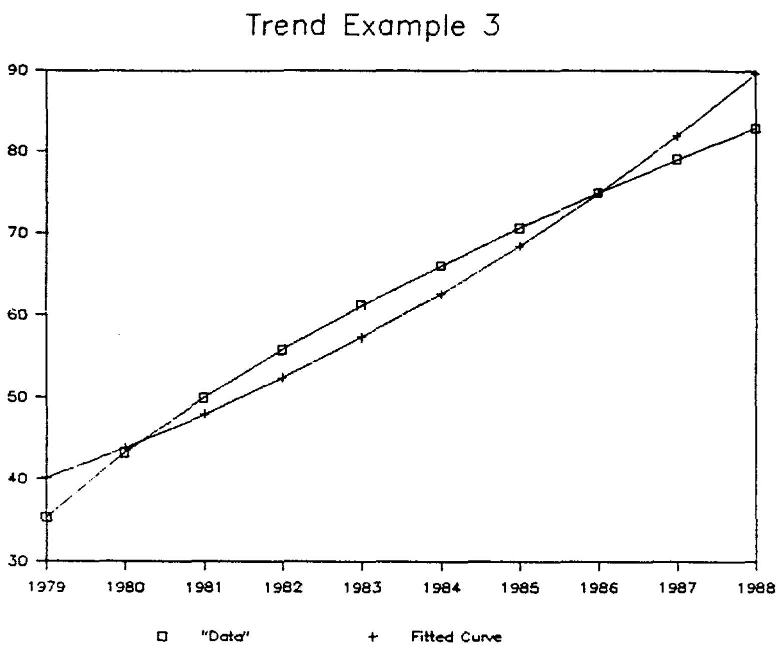
Without drawing a graph, one can often detect a poorly fitting curve by looking at the signs of the residuals. In this example, the residuals are negative, then positive, then negative again, following a clear pattern. When a curve fits well, the signs of the residuals will appear to be distributed more randomly.

One obvious solution is to use a more appropriate model—that is, another type of curve. But industry ratemakers—in both companies and rating bureaus—tend to use the exponential model regardless of how poorly it fits. The underwriters and marketers may then adjust the actuarial indications downward (by a somewhat arbitrary amount) "because of competition" or "for the sake of rate stability" before rates are filed or used. A more realistic approach to trending might lead to better informed ratemaking decisions.


Trend Example 1
60
59
58
57
56
55
54
53
52
51
50
49
48
47
46
45
1979
1980
1981
1982
1983
1984
1985
1986
1987
1988
Data
Fitted Line

Trend Example 2




Trend Example 3
90
80
70
60
50
40
30
1979
1980
1981
1982
1983
1984
1985
1986
1987
1988
"Data"
Fitted Curve

THE DEVELOPMENT OF PROPERTY-LIABILITY INSURANCE PRICING MODELS IN THE UNITED STATES (1ST AFIR INTERNATIONAL COLLOQUIUM, 4/90)

Richard Derrig

The Development of Property-Liability Insurance Pricing Models in the United States 1969 - 1989

Richard A. Derrig

Synopsis

This contribution to the first AFIR Colloquium will summarize the development of insurance pricing models as they have been applied to property-liability (general or non-life) lines in the United States during the period 1969-1989. The development is traced through regulatory decisions and academic research rather than through individual company methods of analysis, the latter being proprietary in nature. This review is especially pertinent to an understanding of the relationship of insurance to general financial markets. The major developments in modern financial economics; namely, the Capital Asset Pricing Model (CAPM), Arbitrage Pricing Theory (APT), and Options Pricing Theory (OPT) all have been applied to pricing the insurance contract and will be reviewed. Finally, fundamental issues faced by insurers again in California with the current implementation of Proposition 103 will be discussed as well as prospects for future development.

October, 1989

1. INTRODUCTION

1. General Setting

The essence of an insurance policy is the promise by the insurer to pay all claims of the insured that are covered by the policy. In return for the insurer's promise, the insured pays the policy premium. In return for the policy premium, the insurer commits its own capital, also known in the literature as surplus or net worth, to assure that the promise will be kept even under adverse or catastrophic circumstances. The determination of the appropriate premium to be charged for the risk of the capital commitment lies at the very heart of the financial dynamics of an insurance company. Actuaries need to be able to determine proper rate levels for the insurance product in ways that are fully consistent with modern financial economics.

I want to describe **ratemaking** in this context as the method for determining the (list) price to be charged for each homogeneous subset of insurance contracts. What makes the insurance transaction essentially different from some other transactions in the economy, and therefore interesting to us, is that the payment of the price (premium) and the delivery of the goods and services (promise to pay all claims) do not occur simultaneously, but rather they can occur with a long time gap between premium and claim payments. This makes the insurance contract risky. Indeed, the insurance contract is risky for <u>both</u> the insured and the insurer.[1] This time gap is also present in other financial intermediary transactions such as stock and bond issues, mortgage contracts, as well as options and future contracts. The pricing of those risky financial contracts is generally accomplished in open competitive markets for capital. Insurance ratemaking, therefore, should recognize that it must coexist with the competitive market pricing of other financial intermediary products and other goods and services in general. For insurance policies in a competitive market we might strike an analogy with prices in the general economy.

By the **Actuarial Premium**, I mean the result of providing the best current value estimate of all the components of the policy contract by means of the insurer's analytic process. In a real sense, the actuarial premium is only the list price for the insurance contract. By the **Market Premium**, I mean the policy premium that results from the actuarial premium after dividends, schedule rating and all other marketing devices have had their influence on the actuarial price in order to match the competitive market sale price. Only in theory, or under strict price controlling regulation, will the best actuarial premium be equal to the dynamic market determined premium.

The purpose of this review is to provide some highlights of the various ways in which the United States property-liability insurers have seen financial pricing models, primarily in the regulatory arena, developed for their products during the past twenty years, 1969-1989. Individual companies will tend to use a method or model, or several methods or models, which the management deems suitable for their own profit targeting or assessment of results. Precisely which companies use which methods or models at various points in time during 1969-1989 is, of course, unknown.

In the sections that follow various models are discussed which are designed to create the Actuarial Premium. Testing whether or not these models produce results which yield true competitive market premiums is very difficult to do and well beyond the scope of this paper. The interested reader can consult a recent paper by Stephen P. D'Arcy and James R. Garven [8 and 10] for the first extensive attempt at an ex-post test of the financial models.

2. Early Regulatory Decisions

The story begins with the watershed Clifford Decision [2] in the so-called "New Jersey Remand case" rendered in 1972 after the State Insurance Department and the State Supreme Court questioned in 1969 the determination of premium rates using a "traditional" 5% profit figure. Various credits for book or accounting returns on invested policyholders funds, unearned premiums and loss reserves were ordered to be included in determining a proper rate. The overall theory employed by Clifford was that the total return to the company from underwriting and investment, on its properly invested capital,[2] would be sufficient reward for the risk of the insurance contract. Clifford set a target operating return, after-tax underwriting plus net investment income (no capital gains), of 3.5% on surplus at the one-to-one level to written premium.

While insurers tried to cope in theory and in practice with the Clifford approach, another pacesetting rate decision was rendered in Massachusetts by Commissioner James M. Stone [19] in the Worker's Compensation case to set 1975 rates. Stone ordered that future underwriting profit margins on premiums be set at whatever level, positive or negative, that would be expected to provide for, when combined with the investment income from a minimum reasonable investment yield, an independently determined target rate of return. The setting of the target return on capital should involve the use of some of the same techniques of financial economics, such as the Capital Asset Pricing Model (CAPM), that were then being applied to regulate returns on monopolistic public utilities.

By 1979, William B. Fairley [5, Chap. 1] had worked out a one-period model for Stone that employed the CAPM to describe the expected returns on both the required surplus and on the portfolio of investments. This dual role allowed for the complete elimination of the dependence of the profit margins on the composition or the actual outcomes of investment portfolios of individual companies. Instead, the margin depended only on the government-bond yield (the risk-free rate of the CAPM), the lengths of the cash flows of each line of insurance, and the systematic risk of underwriting (the underwriting CAPM beta). The modern financial economic paradigm of CAPM had arrived with enough theoretical force to dispense with any dependence on real investment portfolios, according to Fairley.

3. New Approaches in the 1980's

Discontent with the total reliance on the CAPM and the approximations of Fairley's one period approach led to alternate adaptations of another financial economics paradigm to the insurance pricing problem. Stewart C. Myers and Richard A. Cohn, both at M.I.T. at the time, proposed the use of a multi-period discounted cash flow model [5, Chap. 3]. Their approach highlighted the need for surplus allocation and risk valuation at all points of the life of the insurance policy, including the run off of losses. They also explicitly provided for the important consideration of corporate income taxes in the price of the policy. The Myers-Cohn approach has been used in Massachusetts for Automobile and Workers' Compensation rate setting since its introduction in 1981. Disputes over input parameters, however, have been lively and substantial.

A parallel multi-period approach was taken by the New York Compensation Board, and the National Council on Compensation Insurance (NCCI). Rather than using the net present value formulation employed by Myers and Cohn, they used the standard corporate finance technique for evaluation of projects based on their expected internal rate of return [1, Chap. 5]. Once an underwriting profit was selected, and all shareholder flows to and from the company were identified, an expected internal rate of return could be calculated. That calculated rate of return was then compared to an independently determined fair rate of return for workers compensation insurers. The comparative virtues of the Myers/Cohn discounted cash flow model and the NCCI internal rate of return approaches have been documented in a recent summary paper by Cummins [4].

More sophisticated financial models were produced by researchers during the entire decade of the 1980's. Among the notable ones were the efforts of Alan Kraus and Stephen A. Ross [5, Chap. 5] to incorporate both the stochastic nature of the loss process and the financial asset theory known as the Arbitrage Pricing Theory (APT). Their objective was to create a valuation model to explain how the market value of the insurance firm reacts to changes in prices (premiums) it charges. At its simplest level, Kraus and Ross show that because premium income and loss and expense payments are all in nominal dollars, the "fair" premium is affected by inflation only as far as real rates of interest are likely to change. They observe, similar to Fairley and Myers and Cohn, that in case the underwriting betas are negative (insurance losses are a hedge against systematic economic risk), the fair premium will be higher than the (risk-free) discounted expected losses and expenses. Stated differently, there would be a charge to the policyholder for the exposure of surplus to insure the payment of all claims. (See also [2] and [5, Chap. 6]).

Currently, the efforts which show the most promise for future development and understanding have been those which seek to incorporate Options Pricing Theory (OPT) in a fundamental way. In a 1986 paper in the Journal of Finance, Neil A. Doherty and James R. Garven [13] provided for the valuation of insolvency risk and the redundancy of underwriting tax shields in their adaptation of OPT. Meanwhile, J. David Cummins [3] used the stochastic setting of diffusion processes for asset and liabilities to extract risk-based premiums for guaranty funds. Cummins developed both run-off and policy cohort models which produced non-analytic numerical solutions in the more complicated, but realistic, cases. Finally, the author [8] applied Cummins' policy cohort model, using specific variational parameters derived from Massachusetts Automobile and Workers' Compensation lines, in order to derive consistent and interrelated levels of surplus commitment and risk premium charges.

These latter two papers were presented at the First International Conference on Insurance Solvency at the Wharton School, University of Pennsylvania, in 1986. It was at the Solvency Conference that participating actuaries and financial economists exposed the clash between the financial modelling approach espoused by the American researchers and the traditional stochastic variational approach so dominant in the European literature. The common ground at that conference, expected again at AFIR, was the essential role of the multi-period valuation model, especially those models which accommodated all the stochastic aspects of the insurance transaction. The ICIS proceedings are now published in two volumes [7,8] and will be followed by the further progress recorded at the second ICIS conference at Brighton, England during 1989[9]. A third ICIS is planned for 1991 at Erasmus University, Rotterdam, the Netherlands.

The following sections of this review will provide as many details of the developments described above as are needed to give the actuary an appreciation of the financial pricing issues involved and their developing solutions. A final section will discuss the major issues in these approaches, the prospects for discovery and rediscovery of those issues during the important review of property-liability rates now underway in California under Proposition 103, and prospects for future development and understanding.

2. THE NEW JERSEY CASE AND BOOK RETURNS

1. The Origins of the Case.

Rate increases for New Jersey private passenger automobile liability and physical damage insurance, as well as commercial vehicle physical damage insurance, were filed in early 1967 by the appropriate industry rating organizations.[3] Resistance to the requested increase on the part of the regulator led to a denial of the increase in early 1968, an industry appeal to the New Jersey Supreme Court, and a subsequent decision by the Court (In re Insurance Rating Board, 55 N.J. 19(1969)) ordering a remand hearing based upon instructions from the Court. That remand hearing with 33 sessions was held during 1970 and 1971. New Jersey Insurance Commissioner Robert L. Clifford issued a landmark decision on February 3, 1972 in which he delineated new rules for the regulatory determination of the appropriate level of the provision for underwriting profit and contingencies within approved rates.

The core issue for both the original case and the remand was whether the traditional[4] underwriting profit and contingency margin of 5% of premium was appropriate. Recognition was given by all sides to the fact that an insurance company also derives part of its total profit from investing the assets of the company primarily in stocks and bonds but also, to a lesser extent, in real estate. The court evidently (Clifford, p1) found the whole matter "obscure"; required that "more information" be provided on the "amount an insurer should receive as a reasonable profit"; inquired as to the origin of the 5% provision and its justification; and ordered the remand hearing to determine "what is a proper factor for profit and contingency."

It appears from Clifford's Decision (p22) that the principal criterion for weighing the "appropriateness" of the underwriting provision was "the return required on needed funds to attract and retain capital in the automobile insurance business", the so-called capital attraction standard.[5] As a total return standard, this led the parties and Clifford to consider the major subsidiary issues which must arise when judging the appropriate total return to be expected by an insurer after premiums or rates are set. Those issues, which curiously enough have resurfaced once again, twenty years later, in the hearings following the passage in 1988 of California's controversial Proposition 103, are discussed next.

2. The Issues in the Case.

As defined by Clifford (p4), the origin and justification for the traditional 5% of premium underwriting profit and contingency provision became moot by nature of the remand position taken by the industry bureau;[6] namely, that a provision for underwriting profit and contingencies be arrived at "after income from all sources, including capital gains, has been considered." Once the all-income approach is taken, several generic issues were confronted. These issues included:

1. Required rate of return recognizing income from all sources (p. 14-22);
2. Level of invested capital from which to calculate that rate of return (p. 5-12);
3. Sources and expected amounts of income from underwriting and investment (p. 12-13);
4. Risk involved in underwriting and investing so that a proper rate of return can be targeted, one that is appropriate for the risk of the enterprise (p. 6-8, 15-18).

Unfortunately, some major issues were only tangentially mentioned. These issues include:

1. Annual Statement (Book) values and their appropriateness for pricing the sometimes long term commitment of the insurance contract (p1);
2. Loss and Expense Components of the rates, their relation (above or below) to actual incurred values and their effect on the real underwriting profit expected in the rates(p9);
3. Purpose for regulation and the approved profit provision in rates. (p21-22);
4. Limitations on the extent of current knowledge and the precision of estimates of key parameters (p10, 22).

After a review of the issues decided in the case, a few words will be in order on the remaining issues.

Clifford's decision confronts the capital requirement issue first (p. 5-12). The industry's position was that the book values of policyholders surplus (assets minus liabilities) from the decade of the 1960s showed that insurer committed capital in a direct one-to-one relation to premiums written.[7] Opposition witnesses from academia[8] took a theoretical position, based upon "highly technical" theories, that insurers could count only one dollar of capital for every three dollars of written premium without danger of "failure of the insurer." After agreeing that the required capital is tied into the risk of the enterprise, Clifford laments that "the issue remains obscure with respect to an attempt to decide this matter on a mathematical or scientific basis."[9]

In a Solomon-like decision, Clifford cites an earlier New York Insurance Department report on Insurance Holding Companies,[10] creating the (artificial) concept of "surplus-surplus" and finds that a two-to-one written premium to surplus ratio should be used to determine required capital. The Holding Company Report theoretically isolated a portion of policyholders surplus which was "needed" to cover any shortfalls in provisions for losses and expenses for a "reasonable" period of time, in addition to any declines in asset values. That needed or required surplus presumably guarantees the payment of policyholder claims. Any other remaining surplus on the company books is not "needed" and is deemed surplus (extra) - surplus. Ultimately, Clifford found that insurers require a return on all of their committed surplus but at different rates for the needed vs. the un-needed portions.

In subsequent sections, Clifford finds that the rates should target after-tax returns of 3 1/2% of premium on all policyholders surplus (6% on the required surplus) after the inclusion of after-tax net investment income (no capital gains) on policyholders funds supplied through underwriting, i.e., on premium and loss reserves. This, of course, required that insurers forecast various book values for reserve and investment income levels, an adventure that Clifford left to future rate filings. In reaching his decision to target an operating return, underwriting plus net investment income, rather than a total return, Clifford discusses, but does not use, expert testimony that rates of return in the range of 12% to 16% were offered as appropriate.

3. Looking Back on the Decision.

Although the Clifford decision claims no arithmetic relationship, it seems clear that Clifford anticipated insurer's returns on all stockholder funds (one-to-one premium to surplus) at a level in excess of 12%. That return was to be made up of 7% on invested surplus, 3 1/2% on underwriting net of investment income and an unspecified amount of capital gains on the entire levered investment portfolio. The latter, even if confined as it is in the Annual Statement values almost entirely to stock capital gains, could reasonably be expected to be in excess of 1 1/2% of surplus.[11]

Except for the practical effect of providing a regulatory formula for deciding on an appropriate underwriting profit and contingency provision,[12] Clifford's Decision raised, but did not settle, any subsidiary issues. The decision did have precendential value which led to the conclusion that (1) investment income, including capital gains, mattered when setting insurance premiums; (2) the ultimate source for judging the appropriateness of the profit provision, as opposed to the overall rates, was the total return to an assumed investor in a fully equity financed stock insurance company; and (3) derivative underwriting profit provisions would differ by line of insurance and would more likely be near zero for liability coverages than near the traditional 5% level.

In wrestling with the required capital issue, Clifford cited the fact that there were wide differences in (book) premium to capital ratios for individual companies. In concluding that there must be surplus-surplus, Clifford ignored the reality of a clientele effect, i.e., different levels of capital for different organizational forms and different levels of assurances against default on claim payments. The notion of varying levels of required capital, rather than varying income levels, was missing, even as an alternative, from the Decision.[13] He also ignored the problems which arise naturally when market based concepts of risk, return and capital are discussed in relation to book (non-market) values as revealed by the Annual Statement. Only in the combined (unreal) world of no-bond trading and the (real) world of no market value for reserves will market and book values, so necessary to the discussion of concepts and numbers simultaneously, be identical. Finally, he ignored his own finding by permitting a return (1%) on company surplus funds which were deemed "unneeded".

Clifford's light treatment of risk, the essential concept in determining the appropriate level of return under any financially valid scheme [1, p. 125-201], reflected a general reluctance to confront this difficult issue. He dismissed any discussion of theories of risk and, presumably, of pricing that risk, because he found those theories "extraneous to the question before us" (p.22). One should read that statement, as so many others in the Decision, as statements made to satisfy simultaneously the court order for some action involving the profit provision and the need to preserve a viable insurance market (p.24).

Most unfortunate was Clifford's failure to deal with the ultimate purpose of an underwriting profit and contingency factor in approved rates. Under Bureau made and state approved maximum rates, as in Massachusetts, the profit provision should be set as high as feasible for the most adverse of risks so that competition in the form of downward deviations, differentiable classification based pricing, and/or policyholder dividends can find the economically efficient equilibrium values for individual rates. The actual profit outcome in this case will be lower than the provision in the rates and, with experience, can be estimated and forecast. If, on the other hand, the provision in the rates is also intended to be the expected underwriting profit sufficient enough to attract capital, then regulators must eschew the obligatory reduction of company rate requests, unless and until it is shown that the <u>realized</u> underwriting profit is in excess of, on average, the otherwise determined acceptable level.[14] The Massachusetts experience shows that this is an extremely difficult, if not an impossible, assumption to make about regulatory behavior in the United States (Derrig [5, Chap. 6, p. 141]).

We now turn to the market based and theoretical concepts advanced in Massachusetts under Commissioner Stone during the late 1970s.

3. THE 1976 MASSACHUSETTS CASE AND REGULATORY STANDARD RETURNS

1. <u>The 1975 Massachusetts Workmen's Compensation Rate Case</u>

The beginning of the Massachusetts story lies in Commissioner James M. Stone's initial decision on workers' compensation rates on May 22, 1975 [19]. For those rates, the insurance industry had filed the traditional underwriting profit and contingency provision of 2.5 percent of premiums. While most other components of the ratemaking mechanism were justified by relying explicitly on recent data for premiums, losses, and expenses, the underwriting profit provision was a fixed budgetary item seemingly buttressed only by tradition. Stone's knowledge[15] of the importance of investment income to total industry profits most likely led him to demand that the underwriting profit provision be explicitly justified as well.

The ratemaking methods Stone reviewed reflected the industry's commonly held view that investment and underwriting were separate operations. Underwriting profits would emerge from the actual experience of companies using rates with a pro forma markup on sales, the underwriting profit provision. Investment profits would arise from the management of the portfolio of all invested assets. Since total profits from investment and underwriting were at least subject to ex-post review, they would be presumed to be reasonable overall for ratemaking purposes. The underwriting profit provision used in ratemaking would then be deemed reasonable by implication. According to the industry, the process would satisfy the common statutory principle for regulatory review that "due consideration be given to ... a reasonable margin for underwriting profit and contingencies." The Massachusetts ratemaking statute (c. 90, §113B and c. 152 §52C) somewhat similarly required that "due consideration shall be given to ... a reasonable margin for underwriting profit and contingencies (and) investment income on unearned premium reserves and loss reserves...."

Stone would not accept such an indirect treatment of underwriting and investment income. He saw no reason not to mesh the traditional insurance concept of rate regulation with the concept of rate of return regulation common in other regulated sectors of the U.S. economy. The investment income question had just been considered by Clifford in the "New Jersey Remand Case," which held that New Jersey automobile insurance rates were to be computed to yield an after-tax 3.5 percent return on premiums including net investment income (no capital gains) from policyholder-supplied funds.

Stone approved the use of the 2.5 percent underwriting profit provision for workers' compensation rates in 1975 but made it clear that the ratemaking format should also change in Massachusetts to accommodate investment income. His decision stated [19]:

> To compute the true profit one must count all net gains from the insurance transaction, underwriting and investment, and compare those gains with the capital at risk in the transaction. This is the most commonly accepted rate of return measure in the relevant economic literature. While a 2.5 percent underwriting margin is not necessarily unreasonable, it is only a guess at the proper figure until this sort of calculation is made.

In order to pursue this approach, however, Stone had to deal with an important problem: namely, that the insurance commissioner had very little control over the investment operations of insurers and no control over capital market outcomes which provided the investment returns. Clifford had rather neatly sidestepped that issue in the New Jersey case by leaving the investment income determination to future rate hearings.

Stone announced that he had overcome this problem, which he characterized as "the Gordian Knot of measuring investment return in insurance." He noted the wide variation in investment results across companies and over time and concluded that actual investment policies should be ignored in favor of a simple investment policy for ratemaking purposes. He would use the concept of including income from investments in risk-free U.S. Treasury securities as a minimal attainable investment standard for making insurance rates under his total return criterion. This approach of using virtually riskless Treasury investment returns, together with the applicable corporate tax rate, became known as the "regulatory standard" company approach. Stone warned the industry to be prepared for his version of total return regulation for all future rate decisions.

2. <u>Stone's 1976 Automobile Decision</u>

The calculation of an appropriate underwriting profit provision for automobile insurance became an area of acute controversy in Massachusetts with 1976 Bodily Injury Liability Coverage Rate Decision issued by Stone in November 1975. Stone implemented the total return concept by "finding that level of underwriting profit allowance which, if earned along with minimum reasonable investment results, would produce for the average carrier a rate of return on capital equal to that achieved by a typical non-regulated firm of similar risk characteristics."[18] In other words, if he could set an overall target return in some fashion, the underwriting profit provision would simply be chosen to yield the difference between the total return target and the risk-free investment return.

For 1976 rates, Stone adopted the concept of requiring total return to be calculated separately for bodily injury liability and property damage coverages based upon a judgment of the overall risk of the "regulatory standard" company. For the bodily injury liability decision, he used a recent average return for 850 of the largest U.S. corporations plus some upward adjustment to account for the increased riskiness of the insurance sector during inflationary times because of "slow-pay" losses.[17] In his property damage decision later that same year, Stone agreed with expert witnesses at the hearings who suggested that the Capital Asset Pricing Model (CAPM) could provide the necessary measure of risk for calculating the target rate of return. The theoretical and empirical underpinnings of the CAPM beta to be used, however, appeared to be weak. These two hearings produced underwriting profit provisions of -4 percent for bodily injury coverages and 5 percent for property damage coverages.

Stone's model formula was ad hoc but simple and patterned after the calculation of accounting returns. He proposed that the following equation be satisfied prospectively using currently available data:

$$r = (1 - t)[sp + r_f + sR(1 - p)]$$

where

r = the target (total) rate of return
s = the premium-to-capital ratio
t = the tax rate
r_f = the risk-free rate
R = a discount factor from cash flow
p = the underwriting profit provision

Stone's formula includes the major parameters necessary to solve for the underwriting profit provision as the balancing unknown. The parameters included a cash flow schedule; an investment rate; an overall federal tax rate; invested capital both as a base for the total rate of return and as a measure of the leverage of the cash flow from premiums; and a measure of total risk in the formulation of the target rate of return. Stone had made "crude" estimates of the model and parametric inputs. In its approval of his methods, the Massachusetts Supreme Judicial Court warned that this imprecision might not be acceptable in future rate cases (Mintel [15] p. 191).

4. THE FAIRLEY MODEL AND MARKET RETURNS

1. Problems With Accounting Based Models

Theoretical drawbacks were apparent both in the Clifford - New Jersey methodology and in the Stone - Massachusetts procedure for determining an underwriting margin. Clifford's view used an arbitrary and unswerving target return for underwriting (3.5%) together with an adjustment based upon book value investment returns on reserves. Moreover, investment returns on individual assets had to be parsed retrospectively into policyholder returns (income) and shareholder returns (capital gains). Stone's view used a hypothetical regulatory standard company in which all investment income from risk-free securities contributed to an overall total return on invested capital. Neither view confronted the obvious question of how to accommodate prospectively the myriad possible configurations of actual company investment portfolios for which market returns are expected to be earned. The capital asset pricing model (CAPM) provided a neat trick for Fairley to finesse that important question.

2. The CAPM Contribution

In his Opinion, Findings, and Decision on 1978 Automobile Insurance Rates, Stone adopted the methodology proposed by William Fairley and filed by the State Rating Bureau (SRB).[18] Fairley's method employed the CAPM in an attempt to develop a consistent relationship between the assumptions of cash flow, investment, and capital structure, on the one hand, and the treatment of risk on the other. The SRB suggested and Stone agreed to underwriting profit provisions of -4 percent on bodily injury coverages and 2 percent on property damage coverages for 1978 rates.

The central principle of the CAPM is that risk is divisible into systematic (market-related and nondiversifiable) and unsystematic components but that a risk premium is due the investor only for systematic risk.[19] The CAPM rate of return equation is

$$r = r_f + \beta(E(r_m) - r_f]$$

where

r = the required rate of return for a given asset
r_f = the risk-free rate of return
r_m = the rate of return on the market portfolio of risky assets
β = a measure of the asset's systematic risk, which is defined as $cov(r,r_m)/var(r_m)$ where cov( ) denotes covariance and var( ) denotes variance. E( ) denotes expected value.

Fairley's methodology used principles derived from the CAPM to impute income to the regulated company.[20] The company's target return on equity was presumed to be the risk-free rate adjusted for the levered riskiness of investments and underwriting, the latter by an "underwriting beta" which had to be measured indirectly.[21] The CAPM also was used to estimate the investment income that companies should expect to earn.

Fairley used the CAPM to estimate both expected total return on equity and expected investment return. As a result, in theory, the Fairley model's equilibrium underwriting profit margin did not depend on the risk of the company's investment portfolio. That underwriting margin is given by (Fairley's equation 11a):

$$p = -kr_f - k\beta_L[E(r_m) - r_f] + \left[\frac{t}{(1-t)s} r_f \right]$$

where

- p = the underwriting profit margin
- k = a measure of the availability of investable policyholder funds, which is roughly equal to the ratio of reserves to premiums
- r_f = the risk-free rate
- β_L = the underwriting profit beta for the line of insurance
- $E(r_m)-r_f$ = the market risk premium
- t = the overall effective federal tax rate
- s = the premium-to-surplus ratio

In words, the underwriting profit margin reflects a credit for the investment income on policyholders' funds that is offset by an expected reward for the risk of underwriting (negative beta) and by an allowance for federal income taxes. Fairley's use of the CAPM had replaced retrospective book returns with prospective market returns, a more palatable concept for financial economists, if not insurers.

The use of this model, or slight variations, produced expected underwriting profit provisions for Massachusetts automobile insurance rates ranging from +2.3% to -5.3% from 1977 to 1980.

Although the target return/investment return question is seemingly resolved, by using the CAPM, major problems arise with the Stone-Fairley CAPM application. First, the method totally relies upon the unobservable CAPM underwriting beta to load the premium for the risk borne by the exposure of insurer's equity capital. Major difficulties are encountered in any attempt to induce the elusive market beta from insurer's accounting returns matched with asset market returns (Cummins and Harrington [6]). Second, the method intrinsically relied for underlying structure on a one-period total rate of return model. Since the life of the insurance contract is multi-period, approximate methods had to be used to force multi-period market cash flows into book accounting one-period flows, thereby masking the essential structure of the contract. Surplus requirements, an essential area of contention from the beginning of the Clifford proceedings, were erroneously considered as a one-period constant rather than as the life-of-the-policy commitment that is necessary. Finally, disenchantment with the ability of the CAPM to explain fully the returns of asset markets over time led to questioning the use of the CAPM to infer returns for non-traded insurance contracts. All of those problems led to the development in Massachusetts, and elsewhere, of multi-period alternatives to the Stone-Fairley model.

5. MULTI-PERIOD DISCOUNTED CASH FLOW MODELS.

1. Rate of Return Versus Present Value

Two kinds of financial models have been used in regulation of Property-Liability lines in the United States, rate of return and present value models. A **Rate of Return Model** seeks to determine the rate of return on those insurance contracts (the underwriting profit) as that residual profit needed in order that the rate of return on investments plus the underwriting profit equal an appropriate rate of return on the equity invested to underwrite those contracts. Rate of return models are most naturally applicable in a one-period context with the central valuation taking place at the end of the period. For actuarial pricing purposes, since most insurance contracts expect multi-period payments of claims, the simple rate of return model must be reset for the multi-period context to be practical. That simple model is necessarily an approximate or accounting method. Of note is the fact that the Fairley model combines the general rate of return approach with a specific financial rate of return model (CAPM). This results in an equilibrium solution matching the investor's expected return on equity with the insurance company's expected return on operations. The underwriting profit margin is a residual.

A **Present Value Model**, on the other hand, deals directly with the multi-period context by simply equating the present value of the premium payments with the present value of all loss, expense and tax payments. The present value model developed for Massachusetts by Professors Myers and Cohn [5, Chap. 3], and adopted for ratemaking in 1981, highlighted two additional requirements for insurance contracts. First, the present value of losses and expenses must be calculated using a discount rate adjusted for risk. This results in using a discount rate somewhat higher than the prevailing risk-free rate in order to load a positive expected profit. Second, the actuarial premium must contain a provision for the present value of <u>all</u> federal income taxes, taxes on both investment and underwriting income. The inclusion of taxes is of the utmost importance for real applications of these models. For a general discussion of present value versus rate of return models see Brealey and Myers [1, Chap. 5].

2. The Myers/Cohn Model

The Myers/Cohn model is based on the fundamental principle that a fair premium is equal to the present value of the anticipated losses and expenses that must be paid, plus the present value of the income tax liabilities generated by the writing of the policy. The present value of the losses and expenses are estimated by discounting them from the expected date of payment to the present by a risk adjusted discount rate. The discounting procedure accomplishes two things. It credits the policyholder with investment income at the risk-free rate on premium, from the date of receipt of the premium by the company to the date of payment of the losses or expense on the policy. Income is credited to the policyholder at the risk-free rate reflecting the fact that the policyholder does not share in the asset risk inherent in the company's investment decisions. In addition, the discounting process recognizes the compensation that must be paid to shareholders for accepting the risk of engaging in the insurance business, apart from the investment risk associated with the company's portfolio decisions. This underwriting risk is currently measured rather crudely in Massachusetts, in accordance with the capital asset pricing model (CAPM), by the beta of liabilities. This risk is assumed to be the same, per dollar of outstanding liabilities, in each quarter until all losses on the policy are paid. This strong assumption is necessitated by the crude methods used in the past to estimate a risk premium by means of CAPM. However, nothing in the Myers-Cohn model requires that the risk adjustment be derived from CAPM or any other particular theory; they only require that the risk adjustment be the market determined value of the underwriting risk.

Second, the model recognizes that a fair premium must include the present value of the income tax liabilities generated by writing the policy. These tax liabilities include the tax on underwriting income, and the tax on the investment income earned on the assets, whether purchased with funds supplied by policyholders or by shareholders, required to guarantee the company's obligations on the policy. The tax on underwriting income may be positive or negative, depending on whether the underwriting profit provision in the rates is positive or negative. If it is negative, it can be used as a credit against the positive taxes on the investment income, thus reducing the premium that would otherwise be required.

The tax on the investment income on premium funds is a necessary cost of writing insurance which must therefore be included in the fair premium. The tax on investment income on the assets provided by the shareholders is also properly included in the fair premium, because insurance companies pay additional taxes on that investment income, which shareholders would not have to pay if they invested those funds personally. To induce shareholders to invest in an insurance company, they must receive the same risk-adjusted return as they could earn on any other investment.

Thus, the fair premium includes (1) the amounts necessary to pay all expected losses and expenses on the policy, discounted to present value to reflect the investment income that can be earned on those funds before the losses and expenses are paid; (2) compensation to the shareholder for the risk of investments which the shareholder alone bears; and (3) a provision to pay the taxes that a company must pay by virtue of being in the insurance business.

One essential observation that arises from the consideration of a multi-period model is the insurer's commitment of surplus, or underlying capital, during the entire life of the contract. Crude premium to surplus rules, such as invoked in an ad hoc manner by Clifford at two-to-one, do not translate directly to the multi-period context. Myers and Cohn recognized in setting the asset balance each period that an amount of surplus must be committed approximately equal to a fixed proportion[22] of the discounted value of outstanding liabilities. Since the promise to pay all claims is renewable each period (in a market-driven context think of loss portfolio transfers for run-off liabilities), the required surplus commitment must be expected to be renewed when setting the initial premium. This simple observation, based on standard financial principles (constant debt/equity ratio for equivalent projects), leads to accounting (book) allocations of capital more or less in line with New York Regulation 70 than with the fixed all-lines surplus commitment in the one-period rate of return model assumptions of Clifford, Stone, and Fairley.

A second observation by Myers is crucial in the implementation of the present value of the tax portion of the model. Myers showed, in the 1985 Massachusetts automobile rate hearings, that the present value of the tax on investment income does not depend upon the risk of the securities held by the insurance company. It depends only on the risk-free interest rate and on the effective tax rate. This has become known as the Myers Theorem (Derrig [12]).

3. The NCCI Internal Rate of Return Model

As Cummins [4] points out, the insurance contract can be priced by adopting a perspective. From the perspective of the policyholder, valuation of all cash flows between the company and, or on behalf of, the policyholder results in a consistent model for pricing. The Myers-Cohn model adopts this policyholder perspective. The alternative perspective to adopt is that of the shareholder. Valuation of all the cash flows between the company and the shareholder (the infusion of surplus and the receipt of dividends) also leads to a consistent model for pricing. The National Council on Compensation Insurance (NCCI) has adopted [23] the shareholder perspective in using an internal rate of return model for their pricing purposes.

Briefly, the NCCI approach sets up a multi-period cash flow model of surplus inflows, underwriting investment, and tax flows within the company for a policy cohort, and shareholders dividend flows from the excess of expected assets over expected surplus commitments each period. An internal rate of return is calculated from the net flows of surplus commitments and shareholder dividends. These flows will change depending, among other things, on the underwriting profit and contingency provision assumed for the underwriting flows. The calculated internal rate of return is then compared, as in capital budgeting problems, to an otherwise determined target or "fair" rate of return for the riskiness of the line of insurance under consideration. The underwriting profit and contingency provision is judged "fair and reasonable" if the resulting internal rate of return is judged reasonable by some external standard (such as CAPM, Gordon Growth Model or some other financially based market model).

While both multi-period models, Myers-Cohn and NCCI internal rate of return models, incorporate proper surplus flows over the life of the policy, the levels of those commitments remain an area for fruitful future research.

Alan Kraus and Stephen A. Ross ([5, Chap. 5]) derived a multi-period contingent claim model in a 1982 paper in the Journal of Finance. In that paper, Kraus and Ross examined single and multi-period models both under certainty and stochastic constraints. As far as incorporating the financial evaluation of risk, the authors apply the Arbitrage Pricing Theory (APT) model developed by Ross to the insurance context. Kraus and Ross find that since competitive premia are denominated in current dollars, they will rise with inflation. Real rates of interest also play a fundamental role in their model. Further exploration of the contingent claim approach with notions from options pricing theory are considered next.

6. THE USE OF OPTIONS PRICING THEORY

1. The Rationale for Options in Insurance

If we think about it, the insurance contract is quite like a collection of options. Financial options, like puts (the option to sell) and calls (the options to buy) on stocks, are distinguished by their all-or-nothing like payoffs. If, for example, I have a call option to buy IBM for 125 tomorrow, it will net me one dollar for each dollar that IBM is above 125 and nothing for each dollar IBM is below 125. For the right to this option, I presumably paid some premium to acquire that right sometime in the past (usually 90 to 180 days). And I can trade any well known financial options I have in the open options markets at market-determined prices.

Likewise, several options come into play in the insurance policy. Two examples should suffice for this purpose. First, if we think about an ideal insurance transaction, the insured pays the risk premium as the price of the put option he acquires to sell the insurers' assets (including the equity capital) in the case that the insured's claims[24] exceed the expected amount of claims (the risk-premium-free policy premium). Meanwhile, the insured implicitly retains a put on his own (non-premium) assets to sell them in the case that his claims exceed the combined insured/insurer assets, the assets of the company. If this view of the insurance contract is appropriate, and I believe it is, then there is no single answer to the required capital question raised by Clifford in 1972 and California regulators in 1989. Rather, there is a fair premium level to be charged for every level of capital commitment; the higher the surplus commitment, the higher the value of the put option purchased by the insured, and, therefore, the higher the necessary fair premium level. Although this concept is rigorous and correct, like other financial models before it, the Options Pricing Theory (OPT) models bring substantive parametric measurement problems with them.

2. Two Approaches Using Options Pricing Models

Recently, both Cummins [8] and Doherty and Garven [12], have proposed that option pricing theory can be used to determine risk loadings appropriate for insurance contracts. Those studies provide somewhat differing views of the insurance process but each eventually adapts some rather sophisticated notions underlying the financial theory of contingent claims to provide a natural setting for the pricing of insurance and reinsurance contracts. Doherty and Garven prefer to work with a discrete model while Cummins chooses to adapt a continuous model. Both employ normality assumptions for tractability. At bottom, however, their common central view is that the insurance contract provides policyholders with a priority claim on the insurance company's assets (premiums and surplus) in return for a "fair" premium. Intuitively, it then follows that the more assets the company has to satisfy the policyholders claim (the more surplus contributed by shareholders), the more valuable the policyholders claim becomes and the larger the "fair" premium should be. The contingent claims view may provide, therefore, the essential analytic and structural dependence of the premium upon the surplus provided by the company rather than a mere tangential dependency on surplus for including the tax liability in the fair premium, as in the earlier Fairley and Myers-Cohn models.

The options approach by Doherty and Garven [13], is driven by a desire to circumvent the need for direct estimation, as in the case of the Fairley underwriting beta, of the risk premium embedded within the fair price for the insurance contract. They apply the concept of risk neutral valuation of the policyholders contingent claim on the insurer's assets in order to derive the competitive price of the contract and, derivatively, the fair rate of return on equity. Superimposing the necessary option that the government also has on the insurer's assets by virtue of its taxing authority, the authors use the same criterion as Myers and Cohn - the value of the investor's claim on the assets, immediately after the insurance transaction is executed, is the same as the transaction free value of the invested capital - to produce a market driven equilibrium "fair" premium. Separate equations for the insured's option and the government tax option combine to yield a premium solution which depends upon (1) the level of equity commitment (a desirable feature); (2) the variances and covariance of investment and underwriting returns (solace for the industry side of the 1970 New Jersey Remand Case); (3) the marginal corporate tax rate, and the effective tax shield for company investments; and (4) the riskless rate of interest. This formulation views the required rate of return as consisting of three parts (1) the return required in a risk-neutral world without default and tax shield redundancy; (2) the return for bearing systematic risk in a default-free setting; and (3) a premium to compensate for default risk (the insured's retained put option above) and tax shield redundancy, better known as net operating losses (NOLs).

In Cummins's policy cohort model ([3] and [8], p. 283-302) the asset liability process is assumed to be generated by two simultaneous geometric Brownian motion processes with drift.

$$dA = (r_A A - \theta L)dt + \sigma_A A\, dZ_A$$

$$dL = (r_L L - \theta L)dt + \sigma_L L\, dZ_L$$

Where assets A, invested in marketable securities, continually change according to the returns on those invested assets r_A, less the claims payment θL, subject to a random disturbance term with variance parameter σ^2. Liabilities, at some point $\tau = \tau_0$ in the process, also continually change at some rate r_L, less the claim payment θL, subject to its random disturbance term with variance parameters σ_L^2. Further, it is assumed that all liabilities (claim payments) are paid through a claim on the assets A, available to the policy cohort, plus other assets (not included in A) for which a premium Π (A,L) must be paid.

Cummins derives a tractable solution by using the Ito calculus together with the assumptions that

Π reflects only systematic risk.

Systematic risk of liabilities is zero, and

$\Pi(A,L) = \pi(x)\, L$, with $x = A/L$.

These assumptions allow the reduction of the diffusion equations to an ordinary 2nd order linear differential equation in x, the asset/-liability ratio,

$$\pi(r-r_L+\theta) = \pi_X[x(r-r_L+\theta) - \theta] + 1/2\ x^2\ \pi_{XX}\ (\sigma_A^2 + \sigma_L^2)$$

where
- r = risk-free rate, assumed constant
- r_L = rate of return on liabilities, assumed constant
- θ = rate of payment of liabilities, assumed constant
- σ_A^2 = variance of returns on assets, assumed constant
- σ_L = variance of returns on liabilities, assumed constant

With suitable boundary conditions, the fair premium level is given (approximately) by the value of the risk premium, $\pi(1)$, at an asset/liability ratio of unity (the policyholders pre-insurance condition). In the case that the contract is not fully guaranteed, it would be appropriate to deduct the premium $\pi(x)$ for x equal to the asset/liability ratio of the default-possible insurer.

The analytic shape of π is given as follows.

(Diagram #1 here)

3. Implications from the OPT Approach

The useful descriptive resolution of long standing problems (capital requirements, fair rates of return, risk premium) via the OPT approaches is quite appealing. Risk, capital structure and return are all put into the kind of consistent structure where they belong as equilibrium financial model components. Derrig [8] used the Cummins policy cohort model together with underwriting parameters derived from Massachusetts automobile and workers compensation lines of insurance to conclude that, except for physical damage, the New York Regulation 70 premium to capital ratio for automobile and workers compensation were reasonable and that risk premia, as a percent of the present value of liabilities, on the order of 3% to 12% could be appropriate for given levels of underwriting and regulatory[25] risk. Despite apparent shortcomings, most notably the inability to explain the derivation of the equilibrium solution to non-experts (recall Clifford's disdain for theoretical formulae), the application of OPT remains the most promising framework for understanding and valuing the insurance contract.

7. OUTLOOK FOR THE FUTURE

1. The California Rediscovery

On November 8, 1988, California voters approved a ballot initiative known as Proposition 103 which, among other things, mandated a rollback in rates for automobile insurance and some other lines to a level 20% below the level existing one year earlier, November 8, 1987. The ballot initiative also provided for a one year rate freeze unless the insurer was "substantially threatened with insolvency." Subsequent to the one year period, rates could be changed only under a prior approval system with a key change in the criterion for approval.

This setting of financial policy and prices by popular vote violated the insurers rights to due process under the State and Federal Constitutions. Such a decision was handed down on May 4, 1989 by the California Supreme Court (CALFARM INS. CO. v. Deukmejian 258 Cal. Rept. 161 (Cal 1989)) which found that the "Insolvency Standard" was unconstitutional on its face. While the rollback (to 1987) and reduction (20%) were not invalid per se, they were subject to the right of the insurer to demonstrate a particular rate was confiscatory. The Court said it was not concerned with the way rates were set but with whether the result was confiscatory, i.e., not fair and reasonable. The Court reaffirmed that the capital attraction standard of the Hope Decision would stand for the purpose of determining a fair and reasonable opportunity for a return on invested capital commensurate with the risk of the enterprise. In discarding the year-long rate freeze the Court said that, considering the difference between rates which may be the result of current competition (de facto fair) and rates mandated to be 20% below a prior rate level, insurers must be given "an adequate method for obtaining individual relief" from rate which are confiscatory.

The two events of the approval of Proposition 103 and the subsequent Court Decision have created a regulatory review of individual by-line-by company rates unprecedented in U.S. regulatory history. Prior to Proposition 103, the rate statute prohibited inadequate, excessive or unfairly discriminatory rates, but said that a rate in a competitive market could not be held excessive. This latter provision provided for the fiercely competitive California Auto Insurance market prior to the ballot initiative.[26] Under Proposition 103 (1861.05(a)) the standard rate adjustment became "(n)o rate shall be approved or remain in effect which is excessive, inadequate, or unfairly discriminatory. In considering whether a rate is excessive, inadequate or unfairly discriminatory no consideration shall be given to the degree of competition and the commissioner shall consider whether the rate mathematically reflects the insurance company's investment income." Finally, the Court admonished, and the Department of Insurance picked up as a standard for review, "(O)ver the long term the state must permit insurers a fair return ... "

Since the announcement of procedures and schedules for review (the May 11, 1989 announcement set June 3, 1989 as a deadline to file for a review of rates from the rollback and reduction levels), a total of 443 of 724 licensed insurers had filed for exceptions from the rollback by July 3, 1989. Hearings on those company petitions, and on Department-ordered rate reductions, continue as of this writing. Early forms and schedules hinted that Clifford-era book calculations would be required for review. Later information showed the possibility of using some of the financial models discussed above. Unfortunately, the Department, in order to dramatize the fact that they might order rate givebacks,[27] unilaterally and arbitrarily set the rate of return guildline at 11.2%, given a premium to surplus leverage ratio of three to one (recall Clifford). The return level of 11.2% was a 15 year historical average. (The "long term" of the Court's criterion). As an ex-post average, it will only coincidentally be fair as an ex-ante target return, especially when applied with an abnormally low leverage ratio. All of these issues are expected to be thrashed out, as they have been in Massachusetts, during long, complicated and contentious hearings. We await with you, the discoveries and rediscoveries of issues and solutions.

2. An Application to Pricing the Tax Reform Act of 1986

While the California situation will simmer and, perhaps, produce interesting developments between this writing and the AFIR Colloquium, there are several general observations to be made on current and future progress. One might be left with an impression that the development of financial models represents only regulatory or academic exercises. To dispel that notion one important real-life application should be noted.

The Tax Reform Act (TRA) was signed by President Reagan on October 22, 1986. It has set in motion changes to a great many parts of the federal tax code. An analysis of the text of the new tax law, examples of how the tax burden will be calculated, and an analysis of investment strategies were all covered nicely in a May, 1987 CAS discussion paper by Owen Gleeson and Gerald Lenrow [14]. The pricing effects of the changes will all be felt in the calculation of the underwriting profit provision, a calculation not necessarily left to the actuary, but one which can readily be evaluated using a financial model for pricing.

The Myers-Cohn model described in a prior section is flexible enough, while handling the tax liability in a full and proper fashion, to allow calculations and comparisons using alternate tax codes. Those calculations were performed for Massachusetts Automobile and Workers' Compensation rate filings to be effective in early 1987, the first year of implementation. The sum of the effects of the tax code changes on Massachusetts Private Passenger Automobile Insurance in 1988 was to raise the otherwise-determined overall underwriting profit provision from -7.8% to -6.3%. This increase of 1.5% results from the direct incorporation of the Reform Act Provisions relating to (1) the inclusion in taxable income of a portion of the unearned premium reserve, the so-called "revenue offset"; (2) the inclusion of Loss Reserve Discounting for incurred losses and expenses; and (3) the corporate tax rate change to 34% for taxable years beginning July 1, 1987. The changes to the deductibility, for regular tax purposes, of stock dividends and tax-exempt income, so-called "proration", is included in the calculation of the investment tax rate.

Dramatic differences were seen in the effects of the individual tax code changes by line of insurance. While claim payout patterns for Massachusetts automobile are about like the countrywide all lines patterns, those patterns for Massachusetts Workers' Compensation were quite a bit longer. The following results were calculated by line.[28]

TRA Changes

		Auto	WC
1.	Tax Rate Changes	+0.5%	+1.5%
2.	Discounting Reserves	+0.2%	+2.7%
3.	Revenue Offset	+0.8%	+0.8%
4.	Total	+1.5%	+5.0%

Interpreting these results for their countrywide implications yielded an overall estimate of the increase in tax burden of more than $3 billion per year, more than double the estimate made by Congress. That estimate was confirmed recently by a retrospective detailed survey of actual 1987 taxes of major property-liability insurers conducted by Price Waterhouse.

3. <u>Looking Forward</u>

Several promising areas of inquiry have been opened toward the understanding of the financial underpinnings of the insurance contract. Several of the major developments were discussed in earlier sections. The recent book by Neil A. Doherty and Stephen P. D'Arcy [10] provides a useful and readable review of the foundations. Other fruitful avenues of inquiry have been pursued in conjunction with the first and second International Conferences on Insurance Solvency.[29] Although all published contributions from the Conferences are worthy of your review [7, 8, 9], let me highlight a few of them not already mentioned above.

A major area of study has been the development of larger scale technically complex cash flow modelling schemes. Pentikainen [7], Coutts and Devitt [8], the U.K. Solvency Working Party of the Institute of Actuaries [8, 9] and Paulson and Dixit [8] all make substantial contributions to the emerging techniques of cash flow reporting and evaluation. Summary reviews of solvency concepts and methods by Taylor and Buchanan [7], as well as Kahane, Tapiero and Jacques [8], combined with new insights provided by the application of Agency Theory by Garven [8] and regulatory policy by Doherty [8] all help to illuminate a critically important research area.

Contributions to the second ICIS conference [9] by D'Arcy and Garven in testing the validity of the financial models, Butsic in estimating risk premia for loss reserve discounting, Taylor in analyzing underwriting cycles and Cummins in evaluating the effect of capital structure on pricing also provided valuable progress in understanding and technique.

Of central importance to the upcoming ICIS-3 conference in 1991 will be the allocation of capital to lines of insurance. This problem, as well as the other interesting actuarial, statistical, finance and accounting problems, should provide opportunities for AFIR participants to contribute to the expanding frontiers.

NOTES

1. If you can't imagine that your own personal auto policy is risky to you as the insured then think of your company as an insured when it reinsures some of its direct business. The risk to your company is whether the reinsurers will pay, a very real problem in today's markets.

2. The Clifford Decision rejected the historic ratio of one dollar of written premium to one dollar of net worth of an auto insurance company by declaring only half the surplus was "needed" while the other half was "surplus-surplus."

3. The filings were made by the National Bureau of Casualty Underwriters (NBCU) and the National Automobile Underwriters Association (NAVA). Both merged in 1968 into the Insurance Rating Board (IRB).

4. Tradition traces the 5% underwriting profit back to 1921 where the decision was made by the National Convention of Insurance Commissioners to keep underwriting and "banking" or investment profits separate and to set the underwriting profit at 5% plus 3% for "conflagrations," [16, Vol. I, p. 27, 28].

5. The source of the capital attraction standard that is most often cited is Federal Power Comm'n v. Hope Natural Gas Co., 320 U.S. 591 (1944). "By the (Hope) Standard, the return to the equity owner should be commensurate with returns on investment in other enterprises having corresponding risks. That return, moreover, should be sufficient to assure confidence in the financial integrity of the enterprise, so as to maintain its credit and to attract capital" (See also CALFARM v. Deukmegian, 258 CAL Rept. 161 (CAL 1989) 167 ftn. 9).

6. The industry bureau (IRB) position was presented by Dr. Irving H. Plotkin and Dr. Emilio C. Venezian of the consulting firm of Arthur D. Little, Cambridge, Ma.

7. The net written premium to surplus ratio for the decade 1978-1987 was about 1.9 (book value).

8. Clifford specifically cites the testimony of Professors James D. Hammond and Alfred E. Hofflander.

9. For a review of the "science" of required capital since that time see Derrig [8].

10. Report of the Special Committee on Insurance Holding Companies to the Superintendent of Insurance of the State of New York, February 16, 1968.

11. Historical stock market returns were about 8 to 9% in excess of Treasury Bill rates, according to Ibbotson and Sinquefield (See Fairley in [5]). With Treasury Bills yields about 4% in the 1960'2 and stock dividends at about 4-6% on about 1/4 of the assets, that would leave about 6-9% for the expected capital gain component.

12. The New Jersey formula became 3.5% minus net after-tax investment income without capital gains, all put on a pre-tax level by dividing by one minus the marginal corporate rate, which at the time was about 50%. This evolved into the so-called ISO State X method cited by the NAIC in the early 1980s [16, Vol. 1, 106-108].

13. It took until 1975 for New York Regulation 70 to suggest that capital be allocated in different proportions to different lines of insurance. See Derrig [8, p. 305-307].

14. An alternative, which is at odds with free capital market theories but which provides an asymetric assurance to regulators, is ex-post excess profits regulation. See C. A. Williams in [20] for the New York model.

15. Stone served as Commissioner of Insurance in Massachusetts from 1975-1979. His academic background in economics, finance, and insurance qualified him to consider the investment income issue.

16. This concept, as contained in his 1976 automobile rate decision (p. 25), was designed to conform with the criterion in the landmark utility regulation case, Federal Power Commission v. Hope Natural Gas Company, 320 U.S. 591 (1944).

17. The target return for bodily injury liability coverages had a judgmentally added 1.5 percent to guard against "inflation risk" and "unforeseen economic contingencies." Stone's original target rates of return were based upon returns earned by other comparable nonregulated companies on their total capital rather than their equity capital. The use of total capital was criticized in the Massachusetts Supreme Judicial Court's 1976 decision.

18. The SRB was created in 1976 by the Massachusetts Legislature at Stone's request in order to provide additional actuarial expertise to the Division of Insurance and to monitor the competitive rating system. The SRB made a complete filing for 1978 and subsequent rates, usually in opposition to the industry proposal.

19. For background on the CAPM, see for example, Brealey and Myers [1].

20. For a more extensive explanation of this methodology, see Fairley (1979), which is reprinted as chapter 1 of Cummins and Harrington [5].

21. Security betas commonly are measured by regressing the observed rate of return of the security on the rate of return on a market proxy. Because an underwriting security does not trade in an open market, the betas of underwriting must be measured in a different fashion. See, for example, Hill and Modigliani (1981), a revised version of which is included in Cummins and Harrington [5, Chap. 2].

22. The fixed proportion is tied in the Myers-Cohn formulation to a constant per period risk-adjustment. If varying risk adjustments were appropriate over the life of the contract then varying surplus commitment proportions would also be appropriate. No such varying risk adjustments are known buy they are theorized to exist (Hill and Modigliani [5, Chap. 2, 46-48] and Kraus and Ross [5, Chap. 5, 115]).

23. The NCCI internal rate of return model, as well as the New York Compensation Board IRR model [18], was developed with contributions from company actuaries (Richard G. Woll and Claus Metzner) and Council economists (John D. Worrell and David Appel).

24. More realistically would be the case that all insureds' claims collectively exceed the insurer's assets and that each insured shares in some proportion in that excess.

25. Clifford's decision [2, p.21] blamed "bad ratemaking" for any past shortfalls from targeted profit levels as he dismissed the need for any "contingency" margin. The Massachusetts experience (Derrig [5], p. 141) clearly shows that "bad regulation" can also play an essential role in affecting a shortfall.

26. California Department of Insurance figures released in a press conference on August 1, 1989 showed that during 1987 auto insurers lost about 2.7% of premium after the consideration of investment income.

27. Curiously enough, the DOI formula for givebacks calculated large excesses in rates of returns for earthquake insurance in 1988. Will the DOI allow the large inadequacy in 1989 earthquake rates to induce givebacks on the part of the policyholders?

28. Detailed calculations are available from the author.

29. Conference Convenors included Stewart Coutts (UK), Teivo Pentikainen (Finland), Gregory C. Taylor (Australia), J. David Cummins (US), Alfred S. Paulson (US), Richard G. Woll (US) and the author.

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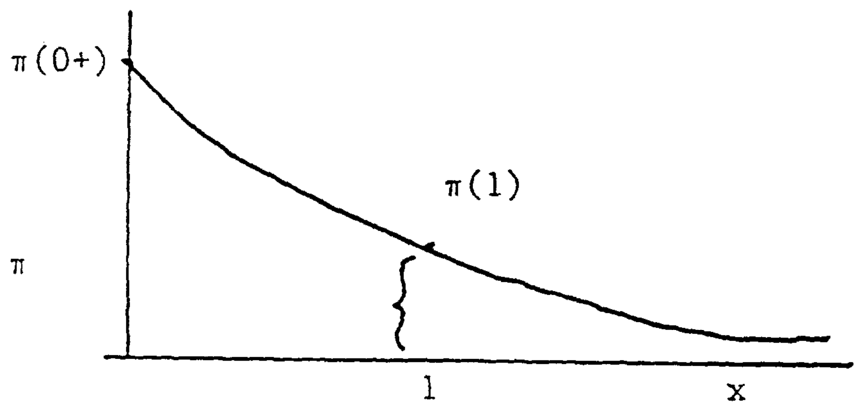
Diagram 1



π (1) IS THE RISK PREMIUM FOR A FULLY GUARANTEED CONTRACT

VALUATION OF DEGREES AND LICENSES FOR EQUITABLE DISTRIBUTION (AMERICAN SOCIETY OF PENSION ACTUARIES, 10/90)

Craig A. Miller

VALUATION OF DEGREES AND LICENSES
FOR EQUITABLE DISTRIBUTION

Following is a sampling of New York cases related to the valuation of degrees, designations, and licenses for equitable distribution. It is not all inclusive. Summaries are intended only as a convenience, relative to the presentation made by Craig A. Miller, FSPA, MAAA, MIAA, CPC, EA, before the New Rochelle Bar Association, Wednesday, March 7, 1990. They are not intended as a substitute for independent legal research and should not be relied upon as such.

Anderson v. Anderson, AD2d (NYLJ September 18, 1989)

Defendant husband's professional degrees and licenses as a health care administrator constituted marital property subject to equitable distribution. He had the following degrees: Masters degrees in health care administration and labor and industrial relations, and licensed nursing home administrator.

Judicial Hearing Officer erred in finding that degrees and licenses were not subject to equitable distribution, notwithstanding his finding that "the wife's expert could not express any opinion as to the monetary value of the degrees and licenses."

"The court should determine the value of the husband's degrees and licenses in accordance with the procedure outlined in McGowan v. McGowan."

Wife is not disqualified from being awarded expert fees pursuant to Domestic Relations Law §237.

Query: **Why wasn't plaintiff wife's expert prepared to testify as to the monetary value of defendant husband's degrees and licenses?**

Arvantides v. Arvantides, 64 NY2d 1033 (1985)

Husband's dental practice is considered marital property, subject to equitable distribution.

"The Appellate Division's reliance on the testimony of defendant's expert in determining the value of defendant's dental practice was erroneous, and constituted an abuse of discretion. Witness was admittedly unfamiliar with the criteria for assessing the value of this type of professional practice, and needed to review certain background materials and case law before expressing an opinion as to the correct valuation factor to use. ... The $100,000 figure testified to by the witness was wholly speculative..."

Query: **Who suffered the finance consequences of the expert's lack of qualifications? The importance of establishing an expert's knowledge and experience before retaining him/her cannot be overemphasized.**

Conner v. Conner, 97 AD2d 88, 89 [2d Dept 1983]

The court concluded "that an academic degree is not property susceptible of distribution pursuant to part B of section 236 of the Domestic Relations Law." In Conner, the husband held a Master's degree in business administration. The court noted that "we may not indulge in the fiction that an academic degree can be evaluated as reified marital property." (97 AD2d 102). See, however, for instance, McGowan v. McGowan.

Cronin v. Cronin, 131 Misc.2d 879 (1986)

Plaintiff wife's law degree acquired during the marriage is marital property subject to equitable distribution even though the plaintiff has chosen to pursue a career with the government at a fixed salary and thus "has no private practice to evaluate."

Defendant husband's marketing degree is not subject to equitable distribution since this court held that an academic degree, unlike a professional license is not property susceptible to distribution. See, however, for instance, McGowan v. McGowan.

Court denies branch of plaintiff's cross motion which seeks to compel the defendant to disclose whether he has expended sums for the hiring of experts and the factual information upon which his experts will express opinions, citing Lobatto v. Lobatto, 109 AD2d 697 (1st Dept 1985).

__De Stefano v. De Stefano__, 119 AD2d 793 (1986)

Medical license constitutes marital property subject to equitable distribution.

"[T]here must be a new trial to determine the exact nature of the parties' agreement and, if it be found that the parties did not intend reimbursement to be the wife's sole recompense, to further determine the value of the husband's medical license and the wife's equitable share thereof."

__Freyer v. Freyer__, 138 Misc.2d 158, 524 N.Y.S.2d 147, (Sup.Ct., Suffolk Co., 1987)

A party's academic degree acquired during marriage is marital property subject to equitable distribution.

Wife's license to practice medicine which was acquired six months __after__ commencement of divorce action and one month after parties were divorced, was marital property subject to equitable distribution.

Trial court was required to take into account income tax considerations in arriving at valuation of parties' professional licenses and academic degrees.

"DRL §236(B)(5)(d)(10) provides that in dividing the parties' marital property, the court must consider the tax consequences to each party. Parenthetically, the court notes that DRL §236(B)(5)(d)(8) provides that the court should also consider the probable future financial circumstances of each party."

"With respect to a party's pension, the courts in New York have come to the realization that there may be serious tax consequences to either or both parties when a court divides pension and/or retirement benefits. ... Certainly, if the courts are going to tax impact with something as speculative as future pension and/or retirement benefits, they must also tax impact with academic degrees and licenses. The court also notes that it would be grossly unfair to divide such assets on their gross value, leaving one of the parties to bear the burden of all future tax liability."

Even though wife's income during marriage exceeded that of husband by approximately $32,500, parties were required to share equally in marital residence, where husband's homemaker services exceeded those of wife by approximately $33,000.

"A husband's homemaker services are oftentimes not put into evidence in equitable distribution cases, but they should be. They are very important to a court's decision, and they were in this case. The practicing matrimonial bar is alerted accordingly."

Court found Ph.D degree equal in value to $302,000 and medical licence equal in value to $500,000.

Golub v. Golub, 139 Misc.2d 440, 527 N.Y.S.2d 946 (Sup.Ct., N.Y.Co., 1988)

A spouses celebrity status (increase in value of wife's acting and modeling career) should be valued as marital property subject to equitable distribution, despite the fact that the spouse's celebrity status is neither "professional" nor a "license." [Extends O'Brien so as not to prejudice a spouse who is married to a non-professional.]

"The same logic used in McGowan to extend marital property to include degrees can be applied to include as marital property a spouse's unique ability to commercially exploit his or her fame."

"The courts should treat all matrimonial litigants equally and should not prejudice nor penalize a spouse who is married to a non-professional who may nevertheless become an exceptional wage earner. ... Clearly, there are certain fields in which the earning capacity exceeds that of other fields which require licensure. When a person's expertise in a field has allowed him or her to be an exceptional wage earner, this generates a value similar to that of the good will of a business."

"There seems to be no rational basis upon which to distinguish between a degree, a license, or any other special skill that generates substantial income. In determining the value of marital property, all such income generating assets should be considered if they accumulated while the marriage endured."

"[T]he skills of an artisan, actor, professional athlete or any person whose expertise in his or her career has enabled him or her to become an exceptional wage earner should be valued as marital property subject to equitable distribution."

__Hickland v. Hickland__, 39 NY2d 1 (1976)

Appellate Division wrongly "charged the wife with having assumed the risk that [shaky] venture would not pay." Where it is clear that "husband has deliberately stripped himself of income for reasons which went beyond the needs of a reasonable occupational choice [, and] it is clear that he is capable of earning a substantial income", wife should not be deprived of support. "Under such circumstances, a husband is under an obligation to use his assets and earning powers if these are required in order to meet his obligation to maintain the marital standard of living."

__Lesman v. Lesman__, 110 Misc 2d 815 (1981), 88 AD2d 153 (1982), __app__ dis'd, 57 NY2d 956

Neither a spouse's medical license (which in and of itself does not generate income) nor advanced academic degree (which "is in reality an individual effort") is subject to equitable distribution in a divorce proceeding. __See__, however, contrary findings of __O'Brien__ and its progeny.

__Maloney v. Maloney__, NYLJ April 15, 1986, at 15, col. 3, __aff'd__, 137 AD2d 666 (2nd Dep't 1988

Spouse's increased earning potential acquired by Board Certification in internal medicine is subject to equitable distribution in a divorce proceeding.

The lower court correctly held that defendant wife was entitled to 35% of the value of plaintiff husband's medical license: $679,828, payable in installments over 10 years.

Since plaintiff failed to produce an expert to testify with respect to the interest rate to be factored into the ten year payout of the distributive award of a portion of the value of plaintiff's medical licence, 8% was selected on the basis of the unrebutted testimony of defendant's expert witness. Likewise, since plaintiff failed to produce an expert to testify with respect to the tax consequences of its distributive award, the court was justified in formulating a distribution plan without consideration of tax laws. "In this regard, we would further note that we are not persuaded by the excuses proffered by the plaintiff on appeal concerning his failure at trial to present any expert testimony whatever on the issue of valuation or tax consequences."

Trial court was found to have acted within its authority in directing plaintiff to purchase and maintain a term life insurance policy for the benefit of the defendant in the amount of the unpaid balance due on the distributive award.

<u>Query</u>: Why didn't plaintiff submit expert testimony:

a. valuing his wife's teaching licence, as an offset to the value of his medical license;

b. addressing the suitability of an 8% interest assumption applied to the distribution of the value of his medical licence; and

c. addressing the question of his prospective tax liabilities?

<u>Marcus v. Marcus</u>, 137 AD2d 131 (1988)

Plaintiff wife is entitled to an equitable share of husband's medical practice in divorce proceeding. However, inasmuch as defendant obtained his license over 30 years ago, during the early years of the marriage, and subsequently built up his psychiatric practice, which was an ongoing and viable enterprise when the action was commenced, "under the circumstances of this case, the plaintiff is not entitled to two separate awards for the defendant's license and psychiatric practice." Since separate awards might lead to a double recovery, "the medical license should be deemed to have merged with and been subsumed by the practice itself."

"[W]hile defendant husband was responsible for the major share of the economic contributions to the marriage, plaintiff's comparatively small financial contributions were significant because they were made early in the marriage and helped enable defendant to pursue a medical education and career; moreover, plaintiff's noneconomic contributions as a full-time parent, spouse and homemaker were also substantial throughout the parties' lengthy marriage."

<u>Matsuo v. Matsuo</u>, 124 AD2d 864 (1986)

"Trial Term improperly calculated the value of the defendant [husband's] medical practice for purposes of equitable distribution," by using the book value of husband's medical professional corporation, "which reflects only the depreciated value of the tangible assets of the corporation minus the liabilities." "As established in O'Brien v. O'Brien (66 NY2d 576,585), a professional license acquired during the marriage is marital property,...[whose] value is the enhanced earning capacity it affords the holder...."

The court determined that even though the plaintiff wife provided expert proof as to the value of the defendant's medical practice, and based this value on the capitalization of earnings, rather than book value, no effort was made by Trial Term to use this information to "analyze the relationship of assets, professional income, liabilities or capital of defendant's medical practice in order to arrive at its value for equitable distribution purposes. Accordingly, the matter must be remitted for that purpose."

Query: **Why didn't defendant seek to value plaintiff's nursing degree?**

McAlpine v. McAlpine, 539 N.Y.S.2d 680 (1989)

Professional distinction of being awarded fellowship in the Society of Actuaries to husband during marriage and any resultant enhanced earning capacity was marital asset subject to equitable distribution.

"[A] trend has developed wherein the courts will consider as a marital asset, the enhanced earning capacity that a party has achieved during marriage by virtue of attaining a professional license, academic degree or other accomplishment. Of course, the value of the enhanced earning capacity is something that must be proven at trial. Here, defendant-husband was awarded a fellowship in the Society of Actuaries during his marriage to plaintiff. Certainly, such distinction may enhance the earning capacity of the recipient thereof. Accordingly, the court holds that such a professional distinction and its resultant enhanced earning capacity is a marital asset." (Emphasis added.)

McGowan v. McGowan, 142 A.D.2d 355, 535 N.Y.S.2d 990 (2nd Dep't 1988); mot. lv. app. den., N.Y.L.J. March 10, 1989 p. 25 col. 1 (2nd Dep't)

Extension of O'Brien. Wife's master degree which was attained during the course of the marriage was marital property subject to equitable distribution. Wife's teaching certificate, conferred during the parties' marriage but as result of education program which had been completed prior to marriage, was not marital property.

"Since an academic degree may, under various circumstances, similarly enhance the earning potential of its holder, we see no valid basis upon which to distinguish such degrees from the professional licenses which pursuant to O'Brien are subject to equitable distribution. Also, considering that the enhancement of one spouse's earning capacity is the thing of value subject to equitable distribution pursuant to the O'Brien case, we conclude that such enhancement of earning capacity is acquired when it is actually achieved, that is, when the work that gave rise to it is finally completed, not at some later point when the completion of that work is formally recognized by the conferral of a degree or license."

"It makes little sense to construe the Domestic Relations Law in such a way as to exempt from equitable distribution an MBA from the Harvard School of Business, which in real terms could be worth hundreds of thousands of dollars, and yet to subject to equitable distribution a license to operate a junk yard (see, General Business Law §60), upon the theory that the latter instrument, but not the former, entitles its holder to engage in a particular trade or profession."

Court focuses on "the extremely unjust consequences which may result from an overestimation [or underestimation] of the present monetary value of the enhancement of a matrimonial litigant's potential future earnings attributable to the knowledge, skill and ability signified by a professional licence, particularly since such an overestimation of value will result in a substantial monetary judgment, which will be enforceable by all of the coercive procedures authorized by law and which, unlike an order directing maintenance or child support, will not be subject to change (see, Domestic Relations Law §236[B][9][b]; cf., Domestic Relations Law §236[B][5][e]; O'Brien v. O'Brien, ... Siegel v. Siegel ...)"

"The license or degree will constitute marital property only to the extent that it is attributable to the work done during the marriage."

Morimando v. Morimando, 536 N.Y.S.2d 701 (2nd Dep't 1988)

The enhanced earning capacity of the husband as a result of his registration as a physician's assistant, with the Division of Professional Licensing Service of the New York State Department of Education, after successful completion of a full time two year course of study, and his certification as a physician's assistant by the National Commission on Certification of Physician's Assistants, is marital property subject to equitable distribution.

__Morton v. Morton__, 130 AD2d 558 (1987)

Plaintiff wife was entitled to 30% of defendant husband's podiatry practice under equitable distribution in a divorce proceeding.

__O'Brien v. O'Brien__, 114 Misc 2d 233, 106 AD2d 223, 66 NY2d 576 (1985)

Precedent setting case holding the future enhanced earning capacity of a professional license (medical license) is marital property subject to equitable distribution.

"[P]rivilege (to practice the profession of medicine), being in the nature of a franchise, was properly considered by the trial court as marital property for the purpose of equitable distribution." (106 AD2d, at p 240.)

Professional license is a thing of value because of the "enhanced earning capacity it affords the holder."

Furthermore, "[t]here is no reason in law or logic to restrict the plain language of the statute to existing practices, however, for it is of little consequence in making an award of marital property, except for the purpose of evaluation, whether the professional spouse has already established a practice or whether he or she has yet to do so. An established practice merely represents the exercise of the privileges conferred upon the professional spouse by the license and the income flowing from that practice represents the receipt of the enhanced earning capacity that licensure allows. That being so, it would be unfair not to consider the license a marital asset." (p. 586)

__Parlow v. Parlow__, NYLJ September 25, 1989

Husband's teaching license had "merged" into his career and had no value for purposes of equitable distribution because its potential worth had already been achieved.

Plaintiff wife's expert was discredited by inconsistent testimony. "Although he agreed that the teaching license had 'merged' in the course of the 15 years the defendant had been employed as a teacher, he valued the defendant's career as though it were a newly acquired license giving no effect to the fact of merger. He failed to reconcile the apparent contradiction of this position with a strikingly different one he had advanced in a publication ... In addition to ignoring the fact of merger, [the expert's] actual method of evaluation in this case is flawed and unacceptable."

The Court accepted as valid plaintiff husband's conclusion that defendant's teaching career has no value whatsoever, based upon the expert's comparison of Mr. Parlow's compensation to that of other teachers with the same training and tenure, covered by the same union contract.

Query: **Why didn't the experts value the "enhanced earning capacity" of Mr. Parlow's teaching licence/career, by comparing Mr. Parlow's prospective income with his teaching licence to what it would be if he didn't have his teaching licence?**

Raff v. Raff, 120 AD2d 507 (1986)

Plaintiff husband's medical license was subject to equitable distribution in divorce proceeding.

Plaintiff husband's expert valued license at $80,500 as compared with Defendant wife's expert's testimony that the value was $422,161. The trial court determined that the plaintiff's enhanced lifetime earning capacity was $600,000, but failed to set forth the facts in support of its conclusions as required by CPLR 4213. Accordingly, the Appellate Division held that a new trial was warranted with respect to the issues of the valuation of the plaintiff's enhanced earning capacity as a result of his medical license.

Award of expert fees to the defendant wife were found to be appropriate.

Savasta v. Savasta, NYLJ September 13, 1989

The certification to practice internal medicine enhanced the husband's earning potential and constitutes a marital asset subject to equitable distribution.

The wife's expert valued the husband's enhanced earning potential at \$891,442.00 - \$1,858,751.00. The husband's expert calculated a value of \$495,117.00. The court found that it was "unable to adopt the analysis of either expert; both conclusions are flawed." By independent methodology, the court determined the value to be \$571,878.00.

Expert fees were awarded to the wife.

Schoenfeld v. Schoenfeld, NYLJ, July 6, 1988 (Supreme Court, Nassau Co.)

There was a partial merger of the doctor's license into his "fledgling practice." Value of the practice was subtracted from the value of the license.

Siegel v. Siegel, 132 AD2d 247, 254, 523 NYS2d 517, appeal dismissed, 71 NY2d 1021, 530 NYS2d 108, 525 NE2d 753

Fluctuation of value of marital asset (i.e. value of professional licence or academic degree) after divorce decree is entered, does not warrant granting of postjudgment motion to modify property distribution.

Tessler v. Tessler, Family Law Review, 1986, Wrigler, J.

"[E]ven were the license to be merged into a practice or as here [where defendant husband doctor was a salaried hospital employee] in the absence of a practice into the husband's 'career,' the question arises as to the method of evaluation of the husband's career choice or indeed whether that career is a marital asset."

Motion of plaintiff wife for expert fees pendente lite to evaluate the husband's license was granted by the court.

Vanasco v. Vanasco, 132 Misc 2d 227 (1986)

A C.P.A. license acquired during the marriage "merges" into the business conducted through said license so that an evaluation of the husband's business, rather than his license, is the correct manner in which to measure the value of said license.

ADDITIONAL CONSEQUENCES OF EXPERT TESTIMONY
FOR EQUITABLE DISTRIBUTION

Following is a sampling of cases related to the additional consequences of expert testimony for equitable distribution. It is not all inclusive. Summaries are intended only as a convenience, relative to the presentation made by Craig A. Miller, FSPA, MAAA, MIAA, CPC, EA, before the New Rochelle Bar Association, Wednesday March 7, 1990. They are not intended as a substitute for independent legal research, and should not be relied upon as such.

Siegel v. Siegel 523 N.Y.S.2d 517 (A.D. 2 Dept. 1987)

Court ruled that the "[o]pinion of the wife's expert ...was overly speculative, and therefore unworthy of belief, for purposes of distribution of marital assets, where expert deliberately inflated value...so as to correspond to values assigned...in connection with insurance claim."

Likewise, court ruled that the "[o]pinion of husband's expert as to value of...corporations under husband's control was unpersuasive, for purposes of distribution of marital assets, in that...true earnings of corporation amounted to figure much higher than that which appeared on corporation's financial statements."

Liddle v. Liddle 410 N.W.2d 196 (Wis.App. 1987)

The court ruled that inasmuch as the petitioner-appellant chose neither to provide the court with expert testimony to contradict the respondent's expert testimony on the valuation of assets at the time of trial, nor to cross-examine the testimony, and as the trial court found the expert assumptions and predictions to be "probably correct", no cross-examination of the expert witness will be allowed at this time.

Povosky v. Povosky 508 N.Y.S.2d 722 (A.D. 4 Dept. 1986)

Although the husband did produce expert testimony of a tax accountant regarding tax consequences on other matters, the tax consequence of lump sum distribution of his pension plan was not addressed. As such, the court ruled that the lower court's computation of the award was correct.

DISTRIBUTION OF PENSION BENEFITS ON DIVORCE: SOME UNRESOLVED ACTUARIAL ISSUES

Arnold F. Shapiro

DISTRIBUTION OF PENSION BENEFITS ON DIVORCE: SOME UNRESOLVED ACTUARIAL ISSUES

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Abstract

The author was involved in a study of the analytical procedures and assumptions for the distribution of pension benefits on divorce. The purpose of the study was (1) to review the positions that the courts have taken; (2) to organize them within an analytical framework; and (3) to identify and articulate the unresolved issues which impede the court's ability to render economically unbiased decisions. This presentation presents some of the findings of that study.

ASPA-90.01 B0878

GENERAL STATEMENT OF THE PROBLEM

Given some assignment date, t,[1] let:

$\tilde{V}_{ti}$ = economic value at time t of marital property i

$\tilde{V}_t = \Sigma_i \tilde{V}_{ti}$

a_{tij} = proportion of property i assigned to spouse j at time t,

where a tilde over a factor indicates a random variable. Then, disregarding the expenses associated with divorce,[2] the problem becomes one of assigning:

$$\sum_i a_{tij} \tilde{V}_{ti}, \quad j=1,2,$$

the total allocation to each spouse, such that

$$\sum_i a_{ti1} \tilde{V}_{ti} = k \cdot \sum_i a_{ti2} \tilde{V}_{ti}, \quad k \geq 0$$

and

$$a_{ti1} + a_{ti2} = 1, \ \forall t,i.$$

[1]In this formulation, the date of assignment is taken as given. In practice, since the date of assignment is a principal determinant of property values, it is a critical factor, and, as such, is often a major point in the litigation.

[2]The expenses associated with a divorce include such things as attorney's fees, expert witness fees, and so on. The formulation is easily extended to incorporate this type of slippage.

THE MODEL BEFORE THE COURTS

Since $\tilde{V}_{ti}$ is a random variable, an economically unbiased model generally would require that

$$Pr[|\sum_i a_{ti1} \tilde{V}_{ti} - k \cdot \sum_i a_{ti2} \tilde{V}_{ti}| \geq \delta] \leq \alpha$$

where δ is the maximum tolerable deviation from economic unbiasness and α is the probability of that occurrence. This fact, notwithstanding, the courts have invariably relied on expected value models which merely require that

$$\sum_i a_{ti1} E(\tilde{V}_{ti}) - k \cdot \sum_i a_{ti2} E(\tilde{V}_{ti})$$

where $E(\tilde{V}_{ti})$ denotes the expected value.

THE PENSION BENEFITS PAYABLE TO THE NONEMPLOYEE SPOUSE

The pension benefits payable to the nonemployee spouse is given by the general formula:

$$\begin{bmatrix} non\text{-}EE \\ Spouse's \\ Portion \end{bmatrix} X \begin{bmatrix} Coverture \\ Fraction \end{bmatrix} X \begin{bmatrix} Value\ of \\ Pension \\ Benefits \end{bmatrix}.$$

A common example of the formulation of a coverture fraction is the case where separation occurred while the employee spouse was still a plan participant. In this instance, the coverture fraction is given by the ratio

$$\frac{Date\ of\ Separation\ -\ \max(Date\ of\ Marriage, Date\ of\ Hire)}{Date\ of\ Valuation\ -\ Date\ of\ Hire}$$

The present value (PV) is:

$$\widetilde{PV}_r^T = \int_{t=0}^{\tilde{U}} \tilde{B}_{r+t} \int_{s=0}^{t} e^{-\delta_s}\, ds\, dt$$

and

$$\widetilde{PV}_x^T = \left[\int_{t=0}^{T} e^{-\delta_t}\, dt\right] \widetilde{PV}_r^T ,$$

ESTIMATING THE RETIREMENT AGE

Before taxes, and assuming a specific set of discount and decrement factors, an economically optimal retirement age is the current age, x, plus the n which satisfies:

$$\max_{n} \left[\int_{0}^{n} (ES)_t \, v^t {}_t p_{r_0}^{aa} \, dt + \int_{n}^{\infty} B_t \, v^t {}_t p_{r_0} \, dt \right],$$

where $(ES)_t$ is the expected salary at time t, v^t is the discount factor, ${}_t p_x^{aa}$ is the probability that a participant aged x will persist as an active participant to age x+t, and B_t is the nominal annual benefit at time t.

PBGC RATES

The most notable characteristic of the PBGC rates is that the interest rates vary with duration. The general form for the expected discounted annuity purchase rate is:

$$\prod_{k=1}^{K} \left[1+i_k\right]^{-n_k} \ {}_{r-x}p_x \cdot APR(r)$$

where i_k is the interest rate earned for n_k years of the deferral period. For PBGC purposes, $K=3$, and the maximum values for the n's are $n_1=7$, $n_2=8$, and $n_3= r-x-n_1-n_2$. The interest assumptions are chosen so that, when used with the mortality assumptions mandated by the regulations, the present values for immediate and deferred annuities are comparable with similar annuity purchase rates found in the industry. The rates contain an allowance for expenses.

THE IMPACT OF TAXES

The impact of taxes on pension benefit is captured in the equations:

$$a_r^* = \sum_{s=0}^{\infty} v_s^* \; {}_s p_x \, B_s^*$$

where:

$$v_s^* = \prod_{k=1}^{s} \left[1 + i_k \cdot (1 - t_k')\right]^{-1}$$

and

$$B_s^* = B_s \cdot (1 - t_s)$$

Here, t denotes the taxes paid on the retirement benefit and t' denotes the taxes paid on the investment income. As indicated, the present value of the tax adjusted annuity at the retirement age r, a_r^*, is derived from a tax-adjusted discount factor, v_s^*, and a tax-adjusted periodic retirement payment, B_s^*.

EXPECTED VESTING

The expected vesting (EV) takes the form:

$$EV(x,j,h) = \int_z^r V(y,j,h)\,{}_{y-x}p_x^{aa}\,\mu_y^{aw}\,dy + V(r,j,h)\,{}_{r-x}p_x^{aa}$$

where z is the larger of the initial vesting age or the current age, x; V(x,j,h) is the vesting at age x under vesting schedule j, given that the participant was hired at age h; ${}_{y-x}p_x^{aa}$ is the probability that a participant aged x will persist as an active participant to age y; and the force of withdrawal operating during the interval of age y to y+dy is μ_y^{aw}. Of course, the implementation of the foregoing may be problematic because of the difficulty of procuring the appropriate decrement data.

PRESENTATION AT SEMINAR ON ENVIRONMENTAL ISSUES (10/90)

William Aldrich

CASUALTY ACTUARIAL SOCIETY - SEMINAR ON ENVIRONMENTAL ISSUES

OCTOBER 1, 1990

My talk today will focus on one key environmental area, namely the problem of pollution from hazardous waste sites, and the means that Congress has chosen to deal with the problem through the passage in 1980 of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), popularly known as Superfund.

The main points that I would like to make are:

1. All experts agree that the scope of the hazardous waste problem in this country is enormous.

2. Under existing law, the potential cost of cleaning up these sites and compensating those who may allege bodily injury and property damage is well beyond the financial capacity of the private business sector.

3. In its ten years of existence the Superfund liability system has proven to be an utter failure, having produced very little in the way of cleanup, but a great deal in the way of complex and costly litigation.

4. Alternatives to Superfund are desperately needed. Some have already been suggested, including one by my company, The Hartford Insurance Group.

5. Finally, the actuarial profession, which to the best of my knowledge has mostly been in the background of this debate, can play a vital role in helping to shape workable alternatives to the present liability system.

Let me start by briefly reviewing the origins of Superfund. In the 1970's Congress became increasingly aware of the threat of soil and groundwater pollution from a great number of hazardous waste sites that gradually had been built up over the years. The highly publicized pollution at the Love Canal Landfill in New York State, and the effect on residents in that area, was the main catalyst that drove Congress to enact Superfund.

Superfund was intended to be a crash program to clean up - through a massive infusion of money - the most serious abandoned hazardous waste sites in the country. By focussing on the old abandoned sites, Superfund was a counterpart to RCRA, the Resource Conservation and Recovery Act, which Congress had enacted four years earlier. While Superfund addressed the cleanup needs of abandoned sites, RCRA established standards for the management of active hazardous waste facilities. In other words, the purpose of RCRA is to make sure these existing active facilities do not eventually become Superfund sites. It is important to keep this distinction in mind because to date most of the hazardous waste pollution problem in this country relates to the old abandoned sites addressed by the CERCLA Act in 1980 rather than the newer facilities regulated under the RCRA Act of 1976.

Superfund looks to two sources of money to perform its functions:

1. A tax, partly from general revenues and partly from various corporate sources. Under the original CERCLA enactment of 1980 this tax produced a fund - called the "Superfund" - of $1.6 billion for the first five years of the program. It was increased to $8.5 billion when the program was reauthorized for another five years in 1986 under an enactment called the Superfund Amendments and Reauthorization Act (SARA). The funding of Superfund under the SARA reauthorization will run out in October of 1991, at which time Congress must again act if the program is to continue.

2. As large as the Superfund seems, both from its name and the amount thus far authorized - $10.1 billion, these government financed cleanups are intended to cover only a small portion of the cleanups contemplated under the legislation. The second source of funding, and by far the most significant, is intended to come from the strict, joint and several liability system established under the Act, and applicable retroactively to events that took place years before enactment of CERCLA in 1980.

Cleanups are to be financed with the Superfund tax money <u>only</u> in emergency situations (subject to reimbursement from the responsible parties) and where no solvent responsible parties can be found. The real success of Superfund hinges upon the ability of the Government to win lawsuits against various categories of private parties who under the law are considered responsible for the pollution. In the vernacular of Superfund they are called PRPs, standing for "potentially responsible parties." The range of PRPs is very large, including not only large industrial corporations, but also small business, lending institutions and municipalities. Unlike a normal public works approach, Superfund is almost exclusively a litigation driven system.

The liability system established under the statute is incredibly severe and intentionally so, as this was thought to facilitate cleanups. Any owner or operator of a site, any transporter of hazardous materials to a site, any generator of hazardous material that ends up at a site can be held liable for the <u>entire</u> cost of cleanup, regardless of how little or how much that person contributes to the site, if there is a release, or threatened release, of a hazardous substance from the site. Thus, the liability system is:

1. <u>Joint and several</u> - one "deep pocket" may have to foot the entire bill, even though there may be other contributors to the pollution.

2. <u>Absolute</u> - i.e. no causal connection need be established between the substance attributable to the PRP and the substance that actually leaked.

3. Strict - no showing of fault or negligence is required.

4. Retroactive - in many, if not most instances, the liability applies to things people did long before the law was created. In this sense, it is analogous to an *ex post facto* law, which in a criminal context is specifically prohibited by the United States Constitution.

The theory behind so Draconian a liability system was that it would generate a huge inflow of dollars from PRPS in a short period of time. This was felt to be necessary to respond to such a critical public health need, and to "make the polluter pay". It was to have all the advantages of a public works program, without the political disadvantage of financing out of general revenues.

Turning for a moment from the liability system to the dollar costs of the system, the projected ultimate cost of cleanup has been estimated by various private and governmental sources to run anywhere from $100 to $700 billion, and perhaps even higher. If there is any one prevailing characteristic of these cost estimates, it is uncertainty. There have been wide ranges in the estimates of the number of sites needing attention, the average cost of cleanup and the time required to do the job. There is even less predictability to the likely cost of private bodily injury and property damage suits that may be filed in the wake of the cleanups. The only point of common agreement is that the final bill will be very large.

Given these two factors, (1) the enormous scope and unpredictability of the cleanup costs, and (2) the arbitrary system for assigning responsibility, it was naive indeed for Congress to expect the PRPs to roll over like tin soldiers and accept their medicine. It was a survival issue, and one punctuated by important notions of fairness. Under these circumstances resistance was inevitable, and that is what has occurred. Instead of a crash program to achieve cleanup in a few years, let's look at what has actually happened:

1. EPA data, as reported in a study by the Institute for Civil Justice, shows that in the first 8 years of the Superfund program only 34 of the then 1,175 on the National Priorities List (NPL) had been fully cleaned up. The NPL is a list of the sites most critically in need of attention. It is a list that is continually growing, and is expected by EPA to exceed 2,000 by the year 2000. Estimates of the average cost of cleaning up an NPL site run as high as $30 million.

2. In a recent Management Review of its own performance, EPA admits "Currently, sites are added to the NPL at a rate that exceeds the rate of cleanup."

3. Studies by both the Institute for Civil Justice and the Congressional Office of Technology Assessment have shown that the Government's spending of Superfund money is very inefficient. Much less than half of the funds appropriated have been spent on actual cleanup.

This kind of poor performance, slow pace of cleanup and inefficient use of available funds, is bound to be the natural outgrowth of a system that depends on establishment of site-by-site liability as its main source of funding.

The Superfund litigation explosion, of course, is not confined to government actions against PRPs. Faced with enormous, unexpected and therefore unbudgeted expenses, it was natural for the PRPs to search desperately for someone else to pay the bill. And so they looked to their insurers. It mattered not that the policy didn't actually cover the risk, as it clearly didn't. In desperation one doesn't worry about such niceties.

And so a secondary level of litigation was spawned, cases brought by PRPs against those who issued them comprehensive general liability policies at the time of the alleged pollution. The insurance industry steadfastly denies that CGL polices were ever intended to cover gradual seepage of pollutants, and therefore, didn't take these coverage claims seriously at first. The industry was shocked, however, by an early New Jersey decision, the Jackson Township case. In that case a New Jersey state intermediate court found coverage for gradual seepage of pollutants in spite of the fact that the policy specifically limited coverage to sudden and accidental pollution events. An even more brazen disregard for policy language occurred in a later New Jersey decision, subsequently reversed on appeal, in which the court acknowledged that the insurer unambiguously intended no coverage, but nevertheless found coverage because of the court's determination of a societal need to broaden the sources of funding as much as possible to cover these huge costs.

Some of these coverage cases are incredibly complex declaratory judgment actions where an insured will attempt to get a judicial resolution in one legal action of its rights against all of its CGL carriers over the past 30 or 40 years at all sites in the country. For example, Westinghouse brought an action against 140 insurers to determine coverage at 74 sites scattered throughout the country. Much of the early legal jousting in this case involved the issue of what courts had jurisdiction to determine coverage at what sites. I think you can easily visualize that this kind of lawyer's paradise isn't what Congress had in mind when it thought it had created a crash program for site cleanup.

I will not attempt to give you any scorecard on the coverage cases to date, except to point out that there now have been a substantial number of decisions in state and federal courts that go both ways. In several instances there are conflicting decisions within a single state. It is clear that neither side is going to win the coverage litigation battle. Perpetuating this senseless war will just be an enormous waste of resources that benefits no one except the trial bar.

The volume of coverage litigation directed against insurers, together with the fact that some cases have gone against us, gives the insurance industry a vital stake in Superfund. It doesn't take much actuarial expertise to realize that the approximately $125 billion of surplus in our entire industry cannot begin to pay for total cleanup costs of our country, to say nothing of the private BI and PD actions. Of course, much less than that $125 billion is available, because only the principal writers of general liability have the exposure. It is in our self-interest, as well as that of society, to find a better way to address this problem.

At least two insurers have proposed specific alternatives to the present system. In 1988 The Hartford proposed the creation of a Comprehensive Environmental Response Authority (CERA) to fund both cleanup and private compensation arising out of pollution events. This was followed a year later by the American International Group's proposal of a National Environmental Trust Fund (NETF) to fund cleanups from commercial premium taxes.

Let me describe The Hartford's proposal first. Knowing that an essential underpinning of Superfund is the strong feeling by Congress and the environmental community that the "polluter must pay," total abolition of the joint and several liability system is probably not politically feasible. Under our proposal, the joint and several system remains intact, but each PRP and insurer has the <u>option</u> of buying out of its retroactive liabilities on an aggregate basis by payment of annual assessments to CERA, which would be a federal agency, probably a Division of EPA. The assessment base would have to be distributed in such a way that it reflects as practically as possible, relative exposures to liability under the present system. The incentive to join CERA would be the substantial relief from present transaction costs as well as the replacement of certainty for open-ended and uncertain future liabilities. The CERA assessments would have to be capped, with Government being willing to pick up any excess needs. The payment mode would be similar to taxation, except that it only comes about through a voluntary agreement by the payer with the federal government. Those who wished to continue with the present site-by-site litigation approach would be free to do so, but we feel most PRPs and insurers would be attracted to the ability under CERA participation to budget for these future assessments in a predictable way.

The purpose of CERA is to take the cleanup problem out of the litigation arena and put it back into the engineering arena, where it belongs. Funds for cleanup would be produced more expeditiously, the pace of cleanup would thus be greatly improved, protracted lawsuits would end and business could once again budget for expenses that now would be predictable. The "polluter pay" principle would not be violated because CERA assessments would be weighted according to information available as to past pollution activity, and because those who wilfully violated the law would be denied access to the program altogether. Since the program applies <u>only</u> to <u>retroactive</u> liability arising out of <u>past</u> pollution, it in no way would interfere with the incentives for good behavior that some feel are built into the Superfund liability system. In short, we feel a program of this type would serve all interests in the environmental area, including that of society as a whole.

In our public release of the CERA proposal, our then CEO, DeRoy C. Thomas, emphasized that CERA was only a beginning in the search for Superfund alternatives and that we would welcome other ideas intended to accomplish the same result. About a year later AIG announced a similar proposal. It calls for funding retroactive cleanup costs through a tax on commercial insurance premiums. This is in a sense a "rough justice" application of the CERA need for an assessment base. It isn't scientific, but it is simple to apply. It isn't scientific because it would only be happenstance if the relative distribution of commercial premiums correlated with relative exposure under the present liability system.

There are other questions raised by the AIG proposal:

1. Since it applies to cleanup only, how does one deal with the enormous potential third party liabilities from past pollution.

2. What would be done about self-insurers? AIG says there would be a substitute system, but doesn't explain what it is.

3. Is the "rough justice" politically acceptable, especially since it apparently does not acknowledge that insurers have lost some of the coverage cases.

4. Will it be viewed as consistent with the continuing Congressional demand that "the polluter must pay"?

In spite of the apparent failure of Superfund, Congress, EPA, the environmental community and others have been very reluctant to admit that it is in need of major change. There are a number of possible reasons for this. One is the tendency to want to wait and see if a new EPA director or a new Presidential administration would produce change. After two administrations and 4 or 5 directors since the program began, one wonders how long this will continue to be a reason for delay.

Another reason is a lack of exact data as to the economic impact on the private sector. There have been general proclamations as to the grave threat of the Superfund liability system to PRPs and insurers, but no firm numbers. Congress is more likely to be spurred to action if it has the means to compare the likely financial impact of the present system with any new proposal it is being asked to consider.

There have been several attempts to obtain such data. The General Accounting Office (GAO) tried to assess the impact on insurers in connection with an insurability study a few years ago. It has recently sought the same information in connection with a current Congressional hearing. ICJ has interviewed both insurers and PRPs for this type of information, as has another privately funded organization called the Coalition on Superfund.

In each such instance the available data in and of itself has not been considered adequate. In the case of our industry, for example, it is not difficult to understand why this is true. Although most of the pollution events have already taken place and much of the litigation has commenced, very few of the cases have reached the stage of maturity where reliable estimates of ultimate losses are possible. Any documentary evidence that is produced is likely to seriously understate ultimate costs, but we don't know by how much. Although we are not as familiar with corresponding accounting practices of the PRPs, we suspect they are having the same difficulties. There have been published reports that the SEC and accounting firms are worried about a possible understatement of these liabilities by PRPs.

Although the data may be limited in terms of actual expenditures, it may be sufficient to begin to make some statistical projections, or a range of such estimates, as to ultimate costs. This very thing was suggested by CAS member Amy Bouska in a recent issue of the Tillinghast publication EMPHASIS. Certainly the tools are out there with which to work. A great deal has been expended in some of the preliminary stages of a cleanup, such as site evaluations and legal transaction costs. Government sources have published a number of estimates as to the number of sites that will need attention, and the average cost of cleaning up those sites. Finally, there are the court decisions. The body of case law on coverage decisions is growing rapidly. Admittedly, they form no consistent pattern, but actuaries are used to dealing with crazy quilts. We may be reaching the point where some reasonable estimates can be made of the ultimate distribution of cleanup costs between the PRP and insurer sectors. This information would be an essential ingredient of a voluntary buy-out program such as CERA.

In short, I think actuaries can play a significant role in solving the problems of the system. There has been widespread frustration over the information gap as respects Superfund data. I think actuaries can fill that gap. Actuaries cannot create data out of thin air. No one expects that. The challenge is a difficult one, but like Amy Bouska, I feel there is enough raw material out there to permit the kind of projections that will lead to better understanding of the problem we are dealing with and point the way to solutions. Perhaps projects of this type have already begun. I'm encouraged to see that one of the topics of this seminar is "Procedures to Estimate the Cost of Environmental Hazards." I hope this is not limited to estimating prospective exposures, but also includes estimates of the much greater retroactive pollution costs. Maybe a new twist can be put on the old joke about actuaries and chaos. In this instance perhaps actuaries can begin to produce some order out of the seeming chaos.

As a final comment, I would like to make note of the importance of coalition building in any Superfund reform effort. Naturally, Congress will be more receptive to a program if it serves the interests of all involved parties. We at The Hartford like CERA for this very reason. It produces a better system from the points of view of the Federal government, environmentalists, the industrial community, local governments, insurers and the general public.

In this connection, let me read to you a comment on Superfund that appeared in a recent magazine publication:

> "SUPERFUND. Perhaps the worst 'pro-environment' idea ever promulgated. This highly publicized program to clean up toxic waste dumps and sue the perpetuators for damages has used a huge $2 billion chunk of EPA money for tiny gain. Since Superfund was enacted in 1980, roughly half of its outlays have gone to legal fees, while only 8% of the culpable polluters have actually made restitution. And of the 1,200 Superfund sites, less than 5% have been given a clean bill of health."

You may be guessing that this commentary appeared in Forbes or Fortune magazine, or something put out by the Insurance Information Institute. It did not. It actually appeared in the May 3, 1990 issue of Rolling Stone Magazine. This to me dramatically illustrates how broad the coalition for Superfund reform can be. It need not be confined to business men in pinstripe suits. There is no reason why these disparate interests cannot join together to pursue their common goal.

1836Q
WCA:em

William C. Aldrich
Vice President
ITT Hartford

ENVIRONMENTAL IMPAIRMENT LIABILITY FINANCIAL REPORTING ISSUES (ENVIRONMENTAL ISSUES SEMINAR, 10/90)

Walter Wright

ENVIRONMENTAL IMPAIRMENT LIABILITY FINANCIAL REPORTING ISSUES

GOOD MORNING.

I AM GOING TO DISCUSS ENVIRONMENTAL IMPAIRMENT LIABILITY (EIL) FINANCIAL REPORTING ISSUES, BUT FROM AN ACTUARIAL RATHER THAN AN ACCOUNTING PERSPECTIVE.

THERE ARE FOUR AREAS THAT I INTEND TO COVER (EXHIBIT I). FIRST, I'LL REVIEW SOME INSURANCE COMPANY DISCLOSURES, FROM 1989 FINANCIAL STATEMENTS THAT I'VE DISTRIBUTED TO YOU. THESE PROVIDE A CLUE REGARDING WHAT INSURANCE COMPANIES ARE CURRENTLY DOING TO REPORT THEIR ENVIRONMENTAL IMPAIRMENT LIABILITIES.

SECOND, I'D LIKE TO TALK TO YOU ABOUT THE ACTIVITIES OF THE AMERICAN ACADEMY OF ACTUARIES' COMMITTEE ON PROPERTY/LIABILITY INSURANCE FINANCIAL REPORTING. ACTUALLY, I BELIEVE THE REASON I WAS PUT ON THE AGENDA FOR THIS SEMINAR WAS TO TALK ABOUT THE WORK THIS COMMITTEE IS DOING IN REGARD TO ENVIRONMENTAL IMPAIRMENT LIABILITIES. WE HAVE NOT ACTUALLY DONE MUCH IN THAT AREA YET, BUT THERE ARE SEVERAL OTHER AREAS OF ACTIVITIES THAT I THINK WILL BE OF INTEREST TO YOU.

THIRD, I WANT TO TALK ABOUT LOSS RESERVE OPINIONS, AND THE PROFESSIONAL GUIDANCE OFFERED BY THE ACADEMY AND THE CAS THAT OFFERS HELP TO US IN DEALING WITH ENVIRONMENTAL IMPAIRMENT LIABILITIES. AS YOU'LL SEE, THIS PROFESSIONAL GUIDANCE RAISES AS MANY QUESTIONS AS IT ANSWERS.

FOURTH, AND MOST IMPORTANTLY, I LOOK FORWARD TO GETTING YOUR IDEAS ON THE RESPONSIBILITY OF THE ACTUARY WHEN IT COMES TO REPORTING ENVIRONMENTAL IMPAIRMENT LIABILITIES. IN ORDER TO PROVOKE DISCUSSION AND SOLICIT OPINIONS, I DEVELOPED, WITH ASSISTANCE FROM AMY BOUSKA, THE TWO PART QUESTIONNAIRE THAT YOU COMPLETED PRIOR TO MY TALK. THE RESULTS OF THE QUESTIONNAIRE HAVE BEEN TABULATED, AND I'LL SHARE THEM WITH YOU AT THE END OF THIS SESSION.

DISCLOSURES IN ANNUAL REPORTS (EXHIBIT II)

THE PACKET OF DISCLOSURES THAT WERE DISTRIBUTED TO YOU CONTAIN DISCLOSURES FROM 1989 ANNUAL REPORTS FOR SIX COMPANIES: AETNA, CHUBB, CIGNA, CRUM & FORSTER, THE HOME AND THE TRAVELERS (APPENDIX). THESE ARE THE ONLY DISCLOSURES THAT WE FOUND, USING THE NEXUS DATA BASE, WHICH CONTAINS FINANCIAL INFORMATION FOR SEC REGISTRANTS.

AS YOU REVIEW THESE SIX DISCLOSURES, YOU'LL FIND SEVERAL COMMON THEMES. GENERALLY, THESE COMPANIES REPORT:

- RESERVE ADJUSTMENTS FOR ENVIRONMENTAL IMPAIRMENT LIABILITIES IN OLD YEARS, MEANING IN THE 1970s AND PRIOR IN MANY CASES;
- STATEMENTS THAT FURTHER RESERVE INCREASES ARE POSSIBLE (WHICH MAY IN FACT SUGGEST THAT THEY ARE PROBABLE);

- o EXPRESSIONS THAT THERE IS SIGNIFICANT JUDICIAL UNCERTAINTY REGARDING THIS LIABILITY;

- o AND THAT THE LIABILITIES CANNOT REASONABLY BE ESTIMATED (WHICH SETS THE STAGE FOR THE COMPANIES TO EXCLUDE ESTIMATES OF THE ENVIRONMENTAL IMPAIRMENT LIABILITIES FROM THEIR FINANCIAL REPORTS, IN ACCORDANCE WITH FINANCIAL ACCOUNTING STANDARD #5. YOU MIGHT CALL THIS THE ACCOUNTANTS' VERSION OF "TAKING THE FIFTH.")

THE AMERICAN ACADEMY OF ACTUARIES (AAA) - COMMITTEE ON PROPERTY/LIABILITY INSURANCE FINANCIAL REPORTING (EXHIBIT III) HAD ITS LAST MEETING IN JUNE. THE COMMITTEE DECIDED TO PROCEED IN THE DEVELOPMENT OF A "WHITE PAPER" PERTAINING TO ENVIRONMENTAL IMPAIRMENT LIABILITIES. HOWEVER, AS OF THIS TIME, THE WHITE PAPER HAS NOT BEEN DEVELOPED AND SO THERE IS NOTHING FOR ME TO REPORT IN THIS REGARD. HOWEVER, THE COMMITTEE HAS HAD SIGNIFICANT ACTIVITY RELATED TO LOSS RESERVE OPINIONS.

IN THE FALL OF 1989 THE COMMITTEE LAUNCHED A STUDY OF INSURANCE COMPANY INSOLVENCIES. ALL INSOLVENCIES FOR THE PERIOD 1969 THROUGH 1987 WERE IDENTIFIED, AND REGULATORS IN ALL FIFTY STATES WERE ASKED TO COMPLETE A QUESTIONNAIRE PERTAINING TO THE INSOLVENCIES IN THEIR STATES. THE RESULTS OF THIS SURVEY, WHICH WILL BE RELEASED SHORTLY, WILL PROVIDE INFORMATION ON WHETHER OR NOT LOSS RESERVE OPINIONS HAD BEEN REQUIRED FOR THE INSOLVENT COMPANIES, WHETHER OR NOT THE OPINION WAS QUALIFIED IN ANY MANNER, WHETHER THE SIGNER OF THE OPINION WAS A MEMBER

OF THE AMERICAN ACADEMY OF ACTUARIES, AN FCAS, AN ACAS, ETC. (EDITOR'S NOTE: SEE "STUDY OF INSURANCE COMPANY INSOLVENCIES FROM 1969 - 1987 TO MEASURE THE EFFECTIVENESS OF CASUALTY LOSS RESERVE OPINIONS"; CASUALTY ACTUARIAL SOCIETY FORUM; WINTER 1991 EDITION.)

AS ANOTHER WAY TO LEARN MORE ABOUT INSOLVENCIES, THE COMMITTEE IDENTIFIED, FROM A SAMPLE OF ALL PROPERTY/CASUALTY INSURERS WITH LOSS RESERVES IN EXCESS OF $100 MILLION, THOSE 25 THAT HAD EXPERIENCED THE MOST ADVERSE DEVELOPMENT FROM 1985 THROUGH 1988. WE HAVE OBTAINED COPIES OF THE 1985 LOSS RESERVE OPINIONS THAT HAD BEEN PREPARED FOR ABOUT 19 OF THESE COMPANIES, AND INTEND TO INVITE THE SIGNERS OF THESE OPINIONS TO MEET WITH REPRESENTATIVES OF OUR COMMITTEE TO DISCUSS "WHAT WENT WRONG." OUR INTENT IS TO GATHER INFORMATION THAT MAY BE USEFUL TO ACADEMY MEMBERS, SO THAT WE CAN LEARN BY THE EXPERIENCES OF FELLOW ACTUARIES.

FINALLY, WE WILL BE WORKING TO DEVELOP COMMON LANGUAGE TO BE USED FOR "QUALIFIED" OPINIONS. WE BELIEVE IT IS IMPORTANT, BOTH FOR ACTUARIES AND FOR REGULATORS, THAT WE CODIFY THE LANGUAGE USED IN LOSS RESERVE OPINIONS TO THE EXTENT POSSIBLE AND APPROPRIATE, SO THAT OUR FINDINGS ARE COMMUNICATED AS EFFECTIVELY AND AS EFFICIENTLY AS POSSIBLE.

LOSS RESERVE OPINIONS - PROFESSIONAL GUIDANCE (EXHIBIT IV)

IN LOOKING FOR PROFESSIONAL GUIDANCE REGARDING LOSS RESERVE OPINIONS WHERE THERE ARE ENVIRONMENTAL IMPAIRMENT LIABILITIES, I HAVE IDENTIFIED FIVE SOURCES:

- THE STANDARD OPINION WORDING, AS RECOMMENDED BY THE NATIONAL ASSOCIATION OF INSURANCE COMMISSIONERS (NAIC)
- THE ACADEMY'S QUALIFICATION STANDARDS
- THE STATEMENT OF PRINCIPLES REGARDING PROPERTY AND CASUALTY LOSS ADJUSTMENT EXPENSE RESERVES, PUBLISHED BY THE CASUALTY ACTUARIAL SOCIETY (CAS)
- CAS PROCEEDINGS
- THE LOSS RESERVE QUESTIONNAIRE, WHICH HAS BEEN DISTRIBUTED AT THE 1988, 1989, AND 1990 CASUALTY LOSS RESERVE SEMINARS.

LET'S REVIEW EACH OF THESE TO SEE WHAT GUIDANCE IT PROVIDES TO THE ACTUARY.

LET'S LOOK AT THE **STANDARD OPINION WORDING** (EXHIBIT V):

- WE'RE TO OPINE WHETHER THE RESERVES ARE "COMPUTED IN ACCORDANCE WITH ACCEPTED LOSS RESERVING STANDARDS AND ARE FAIRLY STATED IN ACCORDANCE WITH SOUND LOSS RESERVING PRINCIPLES." WHAT ARE THE ACCEPTED LOSS

RESERVING STANDARDS FOR EIL? THAT'S ONE OF THE THINGS THAT WE'VE BEEN TRYING TO RESOLVE AT THIS SEMINAR.

- WE'RE TO DETERMINE WHETHER THE RESERVES ARE "BASED ON FACTORS RELEVANT TO POLICY PROVISIONS." WHAT ARE THE POLICY PROVISIONS AS REGARDS EIL? A COMMON THEME THROUGHOUT THIS SEMINAR IS THAT THERE IS MUCH DEBATE AS TO WHAT THE POLICY PROVISIONS MEAN. INSURANCE COMPANIES, IN DENYING COVERAGE FOR EIL CLAIMS, APPEAR TO OBTAIN FAVORABLE COURT RULINGS ABOUT HALF THE TIME; THOSE CLAIMING THAT THE POLICIES COVER EIL ARE ALSO SUCCESSFUL ABOUT HALF THE TIME. SO HOW DO WE, AS ACTUARIES, INTERPRET THE POLICY PROVISIONS AS THEY REGARD EIL?

- WE ARE TO OPINE AS TO WHETHER THE RESERVES "MEET THE REQUIREMENTS OF THE INSURANCE LAWS OF THE STATE OF DOMICILE." I'VE ALWAYS BEEN UNCOMFORTABLE WITH THIS CLAUSE, SINCE IT APPEARS TO REQUIRE THAT THE ACTUARY PROVIDE A LEGAL OPINION. BE THAT AS IT MAY, DOES THE SITUATION BECOME MORE COMPLICATED WHEN WE CONSIDER EIL? IS IT POSSIBLE THAT THERE MAY BE STATE LAWS THAT ARE SPECIFIC IN REGARD TO HOW INSURERS MUST COVER EIL? DO WE, AS ACTUARIES, HAVE ANY WAY OF MONITORING INSURANCE LAWS?

- MOST IMPORTANT, WE'RE TO STATE WHETHER OR NOT THE RESERVES "MAKE A GOOD AND SUFFICIENT PROVISION FOR ALL UNPAID LOSS AND LOSS EXPENSE OBLIGATIONS OF THE COMPANY UNDER THE TERMS OF ITS POLICIES AND AGREEMENTS." THE WORDS "GOOD AND SUFFICIENT" APPEAR PRETTY CLEAR. ALTHOUGH ACTUARIES MIGHT DEBATE EXACTLY WHAT IS MEANT

BY "GOOD AND SUFFICIENT," CERTAINLY "GOOD AND SUFFICIENT" DOES NOT APPEAR TO IMPLY THAT NO RESERVE NEED BE CARRIED IF LOSSES ARE NOT REASONABLY ESTIMABLE, OR THAT, IN THE EVENT OF A RANGE OF EQUALLY LIKELY ESTIMATES, THE LOW END OF THE RANGE SHOULD BE BOOKED. THUS, ALTHOUGH FAS #5 PROVIDES AN "OUT" FOR THE ACCOUNTANT, IT IS NOT CLEAR THAT SUCH AN "OUT" IS PROVIDED FOR THE ACTUARY.

LET'S TURN NOW TO THE ACADEMY'S **QUALIFICATION STANDARDS** AND SEE IF THEY PROVIDE ANY HELP IN THIS AREA (EXHIBIT VI). THERE DOES NOT APPEAR TO BE ANY SPECIFIC GUIDANCE. WE CAN MEET THE CONTINUING EDUCATION REQUIREMENT OF 12 HOURS PER YEAR BY ATTENDING SEMINARS SUCH AS THIS ONE. THERE'S ALSO THE REQUIREMENT OF THREE YEARS OF RELEVANT EXPERIENCE, BUT PRESUMABLY VERY FEW, OR NONE OF US, HAVE EXPERIENCE RESERVING FOR EIL. FORTUNATELY, THERE IS THE GENERAL COMMENT THAT SAYS THAT NEW APPLICATIONS OF ACTUARIAL SCIENCE WILL EMERGE, AND THAT CONTINUED EDUCATION AND APPLICATION OF KNOWLEDGE IN ANALOGOUS SUBJECTS WOULD PROVIDE SATISFACTION OF QUALIFICATION STANDARDS. SO, I SUPPOSE THAT MANY IF NOT ALL OF US ARE QUALIFIED TO SIGN LOSS RESERVE OPINIONS WHERE EIL IS INVOLVED. DOES THAT MAKE YOU MORE COMFORTABLE?

LET'S LOOK NOW AT THE **STATEMENT OF PRINCIPLES REGARDING PROPERTY/CASUALTY LOSS RESERVES** TO SEE IF THE STATEMENT OFFERS ANY GUIDANCE (EXHIBIT VII). FIRST, IN REVIEWING THE DEFINITIONS, WE SEE THAT THE TOTAL LOSS RESERVE IS COMPOSED OF FIVE ELEMENTS, INCLUDING PROVISION FOR FUTURE DEVELOPMENT OF KNOWN CLAIMS AND PROVISION FOR CLAIMS INCURRED BUT NOT REPORTED. THUS, THIS SUGGESTS THAT IT IS NOT PROPER TO RESERVE FOR EIL BASED SOLELY ON

CASE RESERVES, SINCE I BELIEVE THAT MOST OF US WOULD ANTICIPATE THAT THERE WOULD BE FUTURE DEVELOPMENT OF KNOWN CLAIMS AND THAT THERE IS ALSO PROBABLY SOME IBNR.

LOOKING AT THE CONSIDERATIONS SECTION OF THE STATEMENT, WE SEE A COMMENT THAT EXPLAINS THAT REPORTS TO SHAREHOLDERS AND TO SECURITY REGULATORS ARE GOVERNED BY GENERALLY ACCEPTED ACCOUNTING PRINCIPLES (GAAP), AND THAT GAAP RESERVES MAY BE DEFINED DIFFERENTLY FROM STATUTORY RESERVES. WHAT BEARING DOES THIS COMMENT HAVE ON OUR ACTUARIAL OPINIONS? IT SEEMS TO INFORM US THAT GAAP APPLIES TO LOSS RESERVES AND HENCE FAS 5 WOULD APPLY TO LOSS RESERVES, BUT IT DOES <u>NOT</u> SAY THAT THE ACTUARY SHOULD DEFINE THE SCOPE OF HIS OR HER OPINION TO INCLUDE FAS 5 STANDARDS.

THERE IS ANOTHER CONSIDERATION THAT SAYS A RESERVE SHOULD "TAKE INTO ACCOUNT THE DEGREE OF UNCERTAINTY INHERENT IN ITS PROJECTION . . . AN EXPLICIT PROVISION FOR UNCERTAINTY MAY BE WARRANTED BUT THE INDICATED ULTIMATE RESERVE VALUE IS SUBJECT TO A HIGH DEGREE OF VARIABILITY." THIS SUGGESTS A RISK MARGIN IS APPROPRIATE, ESPECIALLY FOR EIL SINCE THERE IS A HIGH DEGREE OF UNCERTAINTY. HOW DOES THIS CONCEPT RELATE TO WHAT APPEARS TO BE THE PRACTICE OF RESERVING ON A CASE RESERVE BASIS.

SOME ACTUARIES HAVE INDICATED TO ME THAT THEY BELIEVE A "STEP LADDER" APPROACH TO RESERVING FOR EIL IS APPROPRIATE, INCREASING THE RESERVES GRADUALLY OVER TIME TO GET THEM TO AN ADEQUATE LEVEL. HOWEVER, SUCH AN APPROACH DOES NOT APPEAR TO BE JUSTIFIED BASED ON THE STATEMENT OF PRINCIPLES.

LET'S LOOK NOW AT THE **PROCEEDINGS OF THE CASUALTY ACTUARIAL SOCIETY** TO SEE WHAT ARTICLES ON ENVIRONMENTAL IMPAIRMENT THERE ARE THAT COULD BE HELPFUL TO US IN OUR WORK (EXHIBIT VIII). I'VE CHECKED, AND FOUND NO SUCH ARTICLES. PERHAPS IN THE FUTURE THERE WILL BE ARTICLES BY MANY OF THE PEOPLE THAT SPOKE AT THIS SEMINAR: AMY BOUSKA, STEVE D'ARCY, CHUCK MCCONNELL, ROGER HAYNE, AND OTHERS. BUT AT THIS POINT THERE ARE NONE. THE PROCEEDINGS OFFER NO HELP AT THIS TIME.

FINALLY, LET'S LOOK AT THE **LOSS RESERVE QUESTIONNAIRE** (EXHIBIT IX). BOB MICCOLIS AND I HAVE PASSED THESE OUT AT THE 1988, 1989 AND 1990 LOSS RESERVE SEMINARS AND THEY ARE AVAILABLE THIS MORNING TO THOSE WHO WOULD LIKE THEM. THE QUESTIONNAIRE IS INTENDED TO PROVIDE A THOROUGH CHECKLIST TO HELP THE ACTUARY ENSURE THAT HE OR SHE IS NOT MISSING ANY MAJOR AREAS OF INQUIRY WHEN EXAMINING LOSS RESERVES.

THERE IS VERY LITTLE ON THE QUESTIONNAIRE THAT CAN BE DIRECTLY RELATED TO EIL CLAIMS. THERE IS A QUESTION THAT SAYS, "DESCRIBE ANY SPECIAL PROCEDURES OR GUIDELINES FOR VERY LARGE OR CATASTROPHIC CLAIMS OR FOR UNUSUAL CLAIMS (ASBESTOS, DES, ENVIRONMENTAL IMPAIRMENT OR OTHER TOXIC TORTS)." FURTHER, THERE'S ANOTHER QUESTION THAT ASKS ABOUT THE EXTERNAL ENVIRONMENT--LEGAL AND JUDICIAL ISSUES. THUS, AN ACTUARY THAT CONSCIENTIOUSLY USES THIS QUESTIONNAIRE WOULD PROBABLY NOT OVERLOOK ENVIRONMENTAL LIABILITIES, BUT THE QUESTIONNAIRE PROVIDES NO GUIDANCE AS TO HOW THESE LIABILITIES SHOULD BE ESTIMATED OR RECORDED.

LET'S LOOK NOW AT THE SURVEY THAT YOU HAD COMPLETED PRIOR TO THIS SESSION. I THINK YOU'LL FIND THE RESULTS INTERESTING, I KNOW I DID. I WAS SURPRISED AT HOW CONSERVATIVE THIS GROUP WOULD BE WHEN IT COMES TO RESERVING FOR EIL CLAIMS.

THE FIRST "CASE" IS FAIRLY SIMPLE (EXHIBIT X, PAGE 1). ALTHOUGH THE COMPANY HAS NEVER THOUGHT IT WAS PROVIDING ANY EIL COVERAGE, COVERAGE ISSUES ARE BEING LITIGATED IN CONNECTION WITH SEVERAL CLAIMS. MANAGEMENT HAS MADE NO ATTEMPT TO ESTIMATE THE POTENTIAL LIABILITIES, ON THE GROUNDS THAT THERE IS NO COVERAGE. YOU, AS AN ACTUARY, ARE ASKED TO PROVIDE AN OPINION ON LOSS RESERVES.

ONLY ONE OF YOU RESPONDED THAT YOU WOULD PROVIDE A CLEAN OPINION IN THESE CIRCUMSTANCES. AT THE OTHER EXTREME, FOUR OF YOU SAID THAT YOU WOULD DECLINE TO PROVIDE A LOSS RESERVE OPINION.

THE REMAINING SIXTY-SEVEN RESPONDENTS STATED THAT THEY WOULD PROVIDE AN OPINION BUT WOULD QUALIFY IT. FORTY-THREE OF THESE WOULD HAVE USED QUALIFICATIONS D. OR E., AS SHOWN ON THE EXHIBIT. ALTHOUGH BRIEF, THESE ARE FAIRLY DETAILED DESCRIPTIONS OF THE SITUATION, ESPECIALLY RESPONSE E.

OF THE EIGHTEEN "OTHER" QUALIFICATIONS, MANY WOULD HAVE BEEN VARIATIONS OF CHOICES D AND E.

THE SECOND "CASE" WAS A BIT MORE COMPLICATED (EXHIBIT X, PAGE 2). GIVEN VARIOUS ESTIMATES REGARDING THE AMOUNT OF EIL COSTS AND THE TIMING OF LOSS AND EXPENSE PAYMENTS, YOU WERE ASKED TO PICK

THE LOWEST RESERVE AMOUNT FOR WHICH YOU COULD ISSUE A FAVORABLE, UNQUALIFIED OPINION. OF THE 74 PEOPLE RESPONDING TO THIS QUESTION, 13 "BACKED OUT", DECIDING THAT THEY WOULD NOT BE ABLE TO PROVIDE AN OPINION AT ALL (AT LEAST NOT AN UNQUALIFIED OPINION), BECAUSE THERE WAS TOO MUCH UNCERTAINTY.

THERE WAS A WIDE RANGE OF ANSWERS TO THIS QUESTION (EXHIBIT X, PAGE 3). NOTE THAT 11 RESPONDENTS WOULD HAVE SIGNED OFF ON AN AMOUNT OF $330 MILLION OR LESS, WHICH IS <u>LESS</u> THAN THE TOTAL OF THE NON-EIL RESERVES PLUS THE "LOW" ESTIMATE OF THE EIL RESERVES. STATED DIFFERENTLY, 11 OF YOU WOULD HAVE SIGNED OFF "CLEAN" ON RESERVES EXPECTED TO BE INADEQUATE BY 27% (OR MORE) OF SURPLUS.

ANOTHER 13 WOULD HAVE SIGNED OFF ON RESERVES IN THE RANGE OF $367 MILLION TO $377 MILLION, WHICH IS SLIGHTLY LESS THAN THE "FUZZY" BEST GUESS.

36 OF YOU WERE MORE CONSERVATIVE, AND WOULD HAVE REQUIRED RESERVES OF ANYWHERE FROM $395 MILLION (THE BEST GUESS PLUS A PROVISION FOR COVERAGE DISPUTE COSTS) TO $520 MILLION (THE HIGH ESTIMATE PLUS A PROVISION FOR COVERAGE DISPUTE COSTS). I WONDER HOW MANY INSURANCE COMPANIES WOULD ACTUALLY BE SO CONSERVATIVELY RESERVED?

****

THANKS FOR THE OPPORTUNITY TO GIVE THIS PRESENTATION - YOU'VE BEEN A GREAT AUDIENCE. WHEN I WAS PREPARING THIS TALK, I WAS CONCERNED THAT THERE WOULD BE SO FEW QUESTIONS THAT I WOULDN'T BE ABLE TO COME CLOSE TO FILLING UP THE ALLOTTED TIME.

THE WAY IT'S TURNED OUT, YOU'VE ASKED SO MANY QUESTIONS AND GENERATED SO MUCH DISCUSSION THAT ITS BEEN A CHALLENGE TRYING TO FINISH THE PRESENTATION ON TIME.

Exhibit I

ENVIRONMENTAL ISSUES SEMINAR

REPORTING ENVIRONMENTAL LIABILITIES (ACTUARIAL PERSPECTIVE)

- INSURANCE COMPANY DISCLOSURES
- ACTIVITIES OF THE AAA'S COMMITTEE ON PROPERTY LIABILITY INSURANCE FINANCIAL REPORTING
- LOSS RESERVE OPINIONS - PROFESSIONAL GUIDANCE
- SURVEY/DISCUSSION

Exhibit II

DISCLOSURES IN ANNUAL REPORTS

COMMON THEMES:

- RESERVE ADJUSTMENTS FOR EIL IN OLD YEARS
- FURTHER RESERVE INCREASES ARE POSSIBLE
- SIGNIFICANT JUDICIAL UNCERTAINTY
- CANNOT REASONABLY BE ESTIMATED

Exhibit III

AMERICAN ACADEMY OF ACTUARIES
COMMITTEE ON PROPERTY-LIABILITY INSURANCE FINANCIAL REPORTING

ACTIVITIES RELATED TO LOSS RESERVE OPINIONS:

- STUDY OF INSURANCE COMPANY INSOLVENCIES FROM 1969-87 TO MEASURE THE EFFECTIVENESS OF CASUALTY LOSS RESERVE OPINIONS

- IDENTIFICATION OF 25 INSURERS WITH MOST ADVERSE DEVELOPMENT FROM 1985-1988

- DEVELOPMENT OF RECOMMENDED WORDING FOR "QUALIFIED" OPINIONS

- DEVELOPMENT OF "WHITE PAPER" ON ENVIRONMENTAL LIABILITIES

LOSS RESERVE OPINIONS
GUIDANCE

- STANDARD OPINION WORDING
- QUALIFICATION STANDARDS
- STATEMENT OF PRINCIPLES REGARDING PROPERTY AND CASUALTY LOSS ADJUSTMENT EXPENSE RESERVES
- CAS PROCEEDINGS
- LOSS RESERVE QUESTIONNAIRE

STANDARD OPINION WORDING

- COMPUTED IN ACCORDANCE WITH ACCEPTED LOSS RESERVING STANDARDS AND ARE FAIRLY STATED IN ACCORDANCE WITH SOUND LOSS RESERVING PRINCIPLES

- BASED ON FACTORS RELEVANT TO POLICY PROVISIONS

- MEET THE REQUIREMENTS OF THE INSURANCE LAWS OF (STATE OF DOMICILE)

- MAKE A GOOD AND SUFFICIENT PROVISION FOR ALL UNPAID LOSS AND LOSS EXPENSE OBLIGATIONS OF THE COMPANY UNDER THE TERMS OF ITS POLICIES AND AGREEMENTS

COMMENT: RAISES QUESTIONS REGARDING EIL

Exhibit VI

QUALIFICATION STANDARDS

SPECIFIC:

EDUCATION - ASSOCIATESHIP EXAMS

RELEVANT EXPERIENCE - THREE YEARS

CONTINUING EDUCATION - 12 HOURS

GENERAL:

NEW APPLICATIONS OF ACTUARIAL SCIENCE WILL EMERGE. CONTINUED EDUCATION AND APPLICATION OF KNOWLEDGE IN ANALOGOUS SUBJECTS WILL PROVIDE FOR SATISFACTION OF QUALIFICATION STANDARDS

COMMENT: NO SPECIFIC GUIDANCE REGARDING EIL

STATEMENT OF PRINCIPLES REGARDING PROPERTY AND CASUALTY LOSS RESERVES

EXTRACTS

DEFINITION:

A TOTAL LOSS RESERVE IS COMPOSED OF FIVE ELEMENTS....(INCLUDING)

- PROVISION FOR FUTURE DEVELOPMENT OF KNOWN CLAIMS
- PROVISION FOR CLAIMS INCURRED BUT NOT REPORTED

CONSIDERATIONS:

REPORTS TO SHAREHOLDERS AND TO SECURITIES REGULATORS ARE GOVERNED BY GENERALLY ACCEPTED ACCOUNTING PRINCIPLES (GAAP). GAAP RESERVES MAY BE DEFINED DIFFERENTLY FROM STATUTORY RESERVES

A RESERVE SHOULD TAKE INTO ACCOUNT THE DEGREE OF UNCERTAINTY INHERENT IN ITS PROJECTION....AN EXPLICIT PROVISION FOR UNCERTAINTY MAY BE WARRENTED WHEN THE INDICATED ULTIMATE RESERVE VALUE IS SUBJECT TO A HIGH DEGREE OF VARIABILITY

COMMENT: RAISES ISSUES REGARDING EIL.

Exhibit VIII

PROCEEDINGS OF THE CASUALTY ACTUARIAL SOCIETY

ARTICLES ON ENVIRONMENTAL LIABILITY:

-
-
-
-
-

COMMENT: NOT MUCH HELP ON EIL

Exhibit IX

LOSS RESERVE QUESTIONNAIRE

DESCRIBE ANY SPECIAL PROCEDURES OR GUIDELINES FOR VERY LARGE OR CATASTROPHIC CLAIMS OF FOR UNUSUAL CLAIMS (ASBESTOS, DES, ENVIRONMENTAL IMPAIRMENT OR OTHER TOXIC TORTS).

EXTERNAL ENVIRONMENT - LEGAL AND JUDICIAL ISSUES

COMMENT:

THESE MAY HELP TO IDENTIFY EXISTENCE OF ENVIRONMENTAL LIABILITIES, BUT PROVIDE NO GUIDANCE AS TO HOW THESE LIABILITIES SHOULD BE ESTIMATED OR RECORDED

SURVEY

CASE 1

You are preparing to provide an actuarial opinion on an insurer's loss and loss adjustment expense reserves. You are informed that the company "has never covered environmental claims," but that coverage is being litigated in several cases. Management states that the company has made no attempt to estimate these potential liabilities, as any attempt to do so might weaken their argument that they have no liability.

	Question	No. of Responses
What action would you take?		
A.	Decline to provide a loss reserve opinion.	4
B.	Provide a clean opinion.	1
Qualify your opinion as follows:		
C.	"Actual losses are apt to vary, perhaps significantly, from estimated losses.	6
D.	"My evaluation only provides for large, unusual claims, such as asbestos, environmental impairment, DES, etc. to the extent that such claims are reflected in the historical loss data base."	20
E.	"The company is currently contesting several allegations that their policies have, in the past, provided coverage for environmental impairment claims. Management's opinion is that no such coverage exists, and thus no reserves have been established for environmental impairment claims. This appears reasonable."	23
F.	Other?	18

CASE 2

($ in millions)

Surplus = $100
Non-EIL reserves = $300

EIL estimates on known sites:

	Low	High
Clean up	$25	$100
Third party	20	50
Natural resources	12	50
	$57	$200

"Fuzzy" best guess = $85

Estimated coverage dispute costs = $10 to $20

Estimated total EIL costs = $67 to $220

Estimated portion of $85 that will be paid in next 5 years = $5 to $20

Estimated portion of coverage disputes cost that will be paid in next 5 years = $5 to $10

Estimated total paid in next 5 years = $10 to $20

CASE 2 (cont'd.)

What is the lowest reserve amount for which you would issue a favorable, unqualified loss reserve opinion?

Amount	No. of Responses	Amount	No. of Responses	Amount	No. of Responses
$300	1	$330	5	$405	13
$305	1	$367	8	$510	3
$310	2	$377	5	$520	8
$320	2	$395	12	None	13

AETNA LIFE & CASUALTY
Annual Report 1989

"Loss and loss expense reserves were increased by $811 million in 1989; corresponding increases made in 1988 and 1987 were $1,389 million, and $1,587 million. The table below shows the increases attributable to prior accident years. The majority of these increases was for recurring losses and related expenses for product liability and toxic substance risks attributable to policies written prior to 1978. An increase in reserves is reflected in reduction of net income for the period in which the adjustment is made."

THE CHUBB CORPORATION
Annual Report 1989

"The uncertainties relating to asbestos and toxic waste claims on insurance policies written many years ago are exacerbated by judicial interpretations of coverage that have tended to erode the clear intent of such policies and by expanded theories of liability. The industry is engaged in extensive litigation over these coverage issues. The outcome is not easily predictable. Management considers the reserves established for these claims to be adequate based on facts currently known and the current state of the law. However, given the expansion of coverage and liability by the courts in the past and the possibilities of similar interpretations in the future, an indeterminable amount of additional potential liability exists under adverse conditions.

"During 1989 and 1988, we experienced overall favorable development of $14 million and $42 million, respectively, on reserves established for losses incurred in previous years. These amounts compare with reserve strengthening of $97 million in 1987. In each of the last three years, we substantially increased reserves relating to asbestos and toxic waste claims. Further increases in 1990 and future years are possible as legal issues concerning these claims are clarified."

CIGNA CORPORATION
Annual Report 1989

"In addition, most major property and casualty insurers, including CIGNA, have been subject to asbestos-related and environmental pollution claims that involve significant unresolved issues regarding liability, policy coverage and other matters. As a result of these uncertainties, the amounts and timing of asbestos-related and environmental pollution unreported claims, and related litigation expenses for unreported and most reported claims, cannot reasonably be estimated. Consequently, charges are expected to be reflected in future results."

CRUM & FORSTER
Annual Report 1989

"C&F continually monitors the adequacy of reserves established to cover claims costs on business written in both current and prior years. Management adjusts these reserve provisions to reflect evolving changes in various factors which affect ultimate claim settlement costs. Such factors include increased damage awards granted by the courts, changes in judicial interpretation of legal liability for environmental cleanup, other recently advanced new theories of liability, and difficulties in collecting reinsurance. Most of these judicial interpretations concerning liability for environmental cleanup are still evolving, and considerable disparity exists in legal determinations made in various jurisdictions. Until a pattern emerges and disparities are resolved through the appellate process, it is not possible to accurately assess their ultimate cost. C&F recognizes the impact of these developments in its financial statements as they evolve and become estimable."

HOME GROUP, INC.
Annual Report 1989

"The Home's loss and loss adjustment expense reserves include certain reserves for pollution liability claims principally relating to the period prior to 1980. These claims are at an early stage of discovery and are therefore not reasonably estimable at this time. Pollution liability claims have the potential for adding to reserve estimates. The process of estimating reserve requirements is necessarily imperfect and involves an evaluation of variables, such as claim frequency and severity, as well as social and economic conditions. Therefore, there can be no assurance that the ultimate liability will not exceed amounts reserved; however, the methods and assumptions used in establishing reserves are consistent with prevailing actuarial practice and are modified periodically based on changes in circumstances."

THE TRAVELERS CORPORATION
Annual Report 1989

"Certain of Travelers subsidiaries are involved in litigation with respect to claims arising with regard to insurance coverages that are taken into account in establishing benefit reserves. On insurance contracts written many years ago, Travelers continues to receive claims asserting alleged injuries and damages from asbestos and other hazardous and toxic substances.

"In relation to these claims, Travelers carries on a continuing review of its overall position and its reserving techniques and reinsurance. The latest review confirms that adequate provision has been made for any obligations now foreseen. It is management's opinion that the ultimate resolution of all claims arising from hazardous and toxic substances will not have any material adverse effect on the consolidated financial position of Travelers."

LOSS COSTS, RATING BUREAUS AND THE WORKERS COMPENSATION CRISIS (CAS CONVENTION, 11/90)

Richard A. Hofmann

"**Loss Costs, Rating Bureaus and the Workers Compensation Crisis**"

By Richard A. Hofmann, ACAS, MAAA

In a recent column in the National Underwriter, the new President of the NCCI, Bill Hager, predicted a "meltdown" of the private workers compensation insurance industry within the next two years unless significant changes take place. Bill did an excellent job of detailing a variety of reforms that are needed in the benefit delivery system and the claim adjudication process, but I believe the likelihood that all of these changes can be implemented in the next two years is not good. However, I believe there are some other changes, which Bill didn't mention, that could have a significant impact on alleviating the crisis in a short period of time. These changes, which relate to regulation and the role of rating bureaus, could be implemented fairly quickly because Bill Hager is both a former insurance commissioner and the kind of guy who can make things happen. The time to act is now, but the key question is, will Bill be able to overcome "institutional gridlock" at the NCCI, and receive sufficient support from his member companies, to make the internal changes necessary to avert a "meltdown" in 1992.

The NCCI has recently made a commitment to filing advisory loss costs, instead of advisory rates, in many states. This voluntary action was taken in response to the activities of an NAIC committee studying workers compensation advisory organizations. To some, this is a significant change. To others, this is just the first step in a series of rating bureau reforms that are badly needed to bring down the government controlled administered pricing system and replace it with a free market system. If the Berlin wall can come down almost overnight, then there's hope for the private workers compensation insurance industry.

In the fall of 1989 ~~Last Fall~~, I was asked to testify before the NAIC committee studying rating bureau activities by its chairman, Bill McCartney. Bill wanted me to discuss a report which I had prepared for Bill Hager, then Insurance Commissioner in Iowa, recommending a new form of regulatory environment which was designed to help solve the workers compensation insurance crisis in that state. This proposal called for a prohibition on the publication of both advisory rates and loss costs.

To help the regulators understand why the publication of advisory rates and loss costs should be prohibited, I asked them to consider the question, what is the proper role of a rating bureau, especially the NCCI, in the workers compensation marketplace today? In my NAIC testimony, I identified six distinct functions which are currently performed by rating bureaus:

1. Maintenance of a statistical plan and collection of data.

2. Conversion of historical exposure and loss data into ultimate loss costs and projection of ultimate historical loss costs into the future in total and by class.

3. Conversion of expected loss costs into classification rates by inclusion of expense and profit provisions.

4. Development of rating plans to adjust manual rates based on individual employer characteristics.

5. Promulgation of experience modifications.

6. Administration of the residual market mechanisms.

So rating bureaus are statistical agents, data processing firms, actuarial advice organizations (i.e. consulting firms), and reinsurance pool administrators. Because residual market pool administration was excluded from the NAIC committees study, my testimony focused on the following questions:

1. Does the workers compensation marketplace need statistical agents?

2. Does the workers compensation marketplace need advisory organizations to publish advisory loss costs?

3. Does the workers compensation marketplace need advisory organizations to publish advisory rates?

My answers were: Yes, Maybe and No. Let me explain.

Statistical Agents

Does the workers compensation marketplace need statistical agents or data collection agencies? Definitely, yes. Without industry aggregate exposure and loss data, new insurers (like my company) would face a significant barrier to entry. The collection of aggregate and individual employer loss data fosters competition by allowing insurers to intelligently price their product.

While traditional wisdom calls for a uniform statistical plan and classification definitions, it may in fact be more appropriate to allow different statistical plans with varying degrees of detail for different types of employers. For example, ever since most states converted from limited to unlimited payroll as the exposure base, the construction industry has been claiming that total payroll is unfairly discriminatory and that hours-worked is the most appropriate exposure base for their classifications; however, the insurance industry has been reluctant to collect the data needed to resolve this issue for much the same reasons that they went to unlimited payroll in the first place. My point here is that data collection agencies should be responsive to the interests of insurers <u>and</u> consumers (and regulators for that matter).

As another example, it may be desirable to have fewer classes, i.e. classes based on the nature of an employers business, than we have presently and collect additional data on other rating variables related to territorial differences, size of employer, and other considerations that may be shown to have a correlation with workers compensation costs. The existence of an aggregate industrywide database enhances competition by allowing insurers to accurately allocate the overall costs of the WC system to the individual employers or groups of employers that incur the losses. This database should be preserved, and enhanced, to promote <u>responsiveness</u> to the changing environment and <u>innovation</u> in actuarial research.

<u>Advisory Organizations - Development of Advisory Loss Costs</u>

Does the workers compensation marketplace need advisory loss costs? Maybe. Theoretically, the availability of statewide loss and exposure information should be sufficient to allow insurers to price their product. However, as a practical matter, some insurers do not have the budget or resources to convert reported historical data into ultimate loss costs and then project these loss costs into the future. Competition is enhanced and economies of scale are achieved by the existence of advisory organizations which can perform the necessary calculations and publish advisory development factors, advisory trend factors, or even advisory loss costs by class on a subscription basis. However, there are several key considerations related to advisory organizations in this context:

1. To promote actuarial research and innovation in general and to encourage the development of additional markets for traditionally non-competitive market segments. It may be advisable to allow for the existence of several advisory organizations.

2. The functions of advisory organizations and statistical agents are separable and need not be performed by the same organization. All advisory organizations should have equal access to the database and no advisory organization should exclusively control what data is collected.

3. Current rating bureau meetings are not open to all interested parties. As a matter of logistics, the small and medium-sized regional insurance companies, and even some of the larger national companies based in other parts of the country, find it prohibitively expensive to consistently attend the rating bureau meetings. At the same time, most rating bureau by-laws prohibit these companies from sending other individuals to collectively represent them at these meetings.

   Committees play a significant role in setting policy at rating bureaus. In light of the demographic makeup of these committees, a key question is, should these committees be allowed to control what loss costs should be filed, what ratemaking procedures should be used, or which state's filing should be prepared first? Should committees be allowed to vote at all, or should they simply be available as a sounding board for advice? If the latter, then why shouldn't rating bureau meetings be open to all knowledgeable parties?

In conclusion, no, advisory organizations are not absolutely necessary, but yes, in the interests of efficiency and cost savings for the entire system, competition is enhanced and economies of scale are achieved by their existence. However, there is no reason why the advisory organization and statistical agent have to be the same entity.

Advisory Organizations - Development of Advisory Rates

Does the workers compensation marketplace need advisory rates? Simply, no. In the spring of 1989, the NAIC recommended that rating bureaus should not be permitted to publish advisory rates. It is not clear why workers' compensation was exempted from this position. I have read through all the testimony from the hearings of the NAIC Working Group, and frankly, I am still not convinced that workers' compensation should be treated differently from any other line of insurance when it comes to publishing advisory rates. To expand, a rate can be viewed as consisting of three components; a loss component, an expense component and a profit component. I have just discussed the loss component in terms of advisory loss costs. The generation of advisory rates amounts to taking advisory loss costs and loading them for the expense and profit components. To understand why I strongly support data collection agencies and also support (though less strongly) their publication of advisory loss costs, but do not support their publication of advisory rates, it is important to understand that the loss component of the rate is by far the hardest to estimate, and is largely beyond the control of the individual insurer. Moreover, insurance is different from most other products in that the primary cost (i.e., the loss component) is not known until long after the product is sold. Thus, pooling of loss experience is essential to reduce the uncertainty in this component and is actuarially appropriate.

With respect to the expense component, insurance is really no different form any other product. These costs are relatively predictable for each individual company, and furthermore, can vary substantially from company to company. So industrywide average expense provisions are inappropriate for individual company ratemaking purposes.

The collection of industrywide expense data in and of itself is not an issue. This data is readily available in publications of the A.M. Best Company. The issue is the publication of benchmark expense provisions for ratemaking purposes, when there is generally no actuarial need to pool industrywide expense data in projecting future costs for a given type of expense. Many insurers tend to rely on benchmark expense provisions as a crutch, without necessarily reviewing the benchmarks to see if they make sense for their own operations.

With respect to the profit component, this is a subjective element, in that it encompasses each individual company's own profitability goals, its own investment portfolio and its own competitive strategy. Industrywide profit provisions are thus inappropriate for individual company ratemaking purposes.

All of these comments on the development of advisory rates apply equally to any line of insurance. Workers' compensation is no different than any other line in this regard. The rest of my testimony dealt with competition in the marketplace and the various tools used by insurers to compete for business. It points out that while the marketplace is competitive, this competition is most intense for large accounts. In all but the competitive rating states, small employers encounter very little price differentiation in the marketplace. Since the vast majority of employers are small, most employers view the workers compensation marketplace as a monopoly. In my testimony, I called for a variety of changes in rating bureau practices and work products, including a ban on all mandatory bureau rating plans. While space does not permit me to discuss these issues in detail, a complete copy of my testimony may be obtained from the NAIC.

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How does this testimony relate to the workers compensation insurance crisis?

For some time now, Gary Countryman, the President and CEO of Liberty Mutual, has been calling for the formation of a "national advocacy organization" that would have workers compensation reform as its single most important interest. I think, without question, the National Council on Compensation Insurance (NCCI) should be that organization. However, before the NCCI can be successful in this role, it would seem that some reform is necessary. I suggest that the Iowa proposal serve as a blueprint for these reforms.

I believe rating bureaus bear significant responsibility for some aspects of the workers compensation crisis: flaws in the classification ratemaking process, mandatory and overly rigid experience rating plans, and poorly administered residual market pools all contribute to the crisis. I would like to challenge the insurance industry to re-evaluate the role of rating bureaus and consider limiting their role to the establishment of standardized policy forms, the promulgation of a statistical plan, and the collection and dissemination of both individual risk and aggregate industry historical data. I suggest that each state should have its own workers compensation database, with the NCCI serving as an umbrella organization promoting policy form and statistical reporting consistency between states and performing research on the underlying causes of cost trends around the country.

Presently, too much time, energy and resources at the rating bureaus are absorbed by the promulgation and defense of industrywide rate filings. I believe the workers compensation system would be much better served if rating bureaus got out of the "actuarial advice" business and focused their efforts on the publication of high quality actuarial data, i.e. better data than what we have today. If ISO follows suit, the pressure to repeal

McCarran-Ferguson should dissipate significantly.

The publication of prospective cost estimates (like advisory rates or loss costs) by an organization owned by the insurance industry and controlled by its largest members is clearly unacceptable from an anti-trust perspective because judgmental decisions, i.e. advice, is required. The insurance industry cannot brush off the monopolistic and anti-competitive appearance of these activities. Why not let the leading consulting firms publish, on a subscription basis, advisory loss costs for insurers to use based on data collected by statistical agents? Frankly, I think the existence of competing "advice" firms may lead to new, innovative ways to price workers compensation.

I am calling on the insurance companies which govern the rating bureaus to take a hard look at rating bureau activities. Why does the industry let one organization make rate filings on behalf of all insurers, when these filings are easy targets for intervenors and so called "consumerists" to attack? Wouldn't insurers rather have better, more current actuarial data from which to make appropriate pricing decisions on their own? If some insurers don't have the resources to make these decisions, why don't they let an independent consulting firm do it for them rather than their competitors? Insurers can't be expected to make rate filings based on their own loss data, but if industrywide loss data is available and insurers are forced to make rates using their own expense assumptions and actuarial judgments, then there will be more price differentiation in the marketplace and potential intervenors will be less likely to contest rate filings.

Furthermore, if statistical agents can focus their attention on producing better actuarial data and researching the underlying causes of cost trends, then regulators and legislators will work with them (instead of against them) and the need for double digit rate increases in the future could be alleviated. I believe the Model Data Reporting Bill recently passed by the NAIC is counterproductive and not the answer to our problems. Claims administrators need to spend more time on cost containment rather than entering more data into the computer. Most of this data is already supplied to the workers compensation agencies, so they should be responsible for coding the data.

I have a high regard for the many talented people that work at the NCCI and other rating bureaus, and it is in my company's best interest that these organizations survive and thrive. I'd like to work with the NCCI to help avert the meltdown that Bill Hager has predicted. While I realize that these comments will not endear myself to the NCCI's senior management, I do ask that they and their member companies open up to some new ideas and different perspectives, and at least think about what I have had to say.

THE CHANGING REGULATORY ENVIRONMENT (SEMINAR ON RATEMAKING, 3/91)

D. Lee Barclay

CAS SEMINAR ON RATEMAKING
"THE CHANGING REGULATORY ENVIRONMENT"
March 14, 1991

D. Lee Barclay, FCAS, MAAA

Introduction

Why would a casualty actuary, in his or her right mind, become a regulator?

Maybe there's no good answer for that. But I can tell you this: It's not because the pay is better than in the private sector. It's not for the excitement of attending NAIC meetings at exotic locations throughout the United States. (I remind you that this year's NAIC Spring Zone meeting is to be held in Charleston, West Virginia.) It's not for the pleasure of reviewing totally unorganized rate filings prepared by underwriters or marketers who are unfamiliar with actuarial methods. It's not for the privilege of examining companies whose loss-reserving data base contains no more than what is necessary to fill out Schedule P. And it's not for the sheer joy of doing battle over a disapproved rate filing or an examination adjustment to reserves.

As you can tell, I love my job!

Whatever the reason, by the last count I have, "Government" employs about 40 CAS members, and all but a handful of these work for state insurance departments. That's about 2% of the CAS membership. As a member of this tiny minority, I appreciate the opportunity to speak to you today—assuming, of course, that you can temporarily set aside your questions regarding my sanity.

As an actuary and a regulator, I would like to focus on the actuary's role in rate regulation, my perception of current trends in rate regulation, and some key questions for the future.

The Regulator's Role

The role of every regulator is largely determined by state law. As an actuary in regulation, I must work under this restriction. For everything I do, I must find my authority in a statute. If the authority is not there, I can't do it. If something I do is beyond that authority, it can be undone through the administrative hearing process, or through the courts--embarrassing both myself and the Commissioner's Office.

Even in prior approval states such as Washington, it is clear that competition--not the Insurance Department--is the primary regulator of rates. Whether competition is an adequate regulator of rates will always be a matter of debate, and I don't propose to answer that question today. In theory, at least, competition should result in rates that are neither excessive nor inadequate--rates that are in line with insurers' costs. And in theory, competition should yield rates that are not unfairly discriminatory--because adverse selection gives insurers an incentive to develop more accurate classification systems.

However, I believe that rate regulation has significant benefits. First of all, it is a needed control where competition is lacking. The degree of competition varies by line, by region (even within a state), and over time. And the degree of competition cannot always be easily determined from the market structure. For example, in my state there is heated competition for medical malpractice business, even though there are only about five active insurers in this market and one of them has a 50% market share. Many more companies sell inland marine insurance, but the level of competition is much lower. In the context of time, when the rate cycle turns and the soft market becomes hard, some sellers abandon some classes, but there are still many sellers. The nature of the competition is suddenly different, however.

Second, rate regulation educates insurers. There are a surprising number of small- to medium-sized companies out there who simply do not know what they're doing when it comes to making rates. They have heard the word "actuary," but they have never used one. Concepts such as trend, loss development, and credibility are unfamiliar to them. The rate approval process forces them to learn ratemaking methods. (Some have even attended the CAS Seminar on Ratemaking, at a regulator's suggestion.) The approval process protects these amateur ratemakers from making poor decisions based on false interpretations of data. And it shields their competitors from the effects of having someone out there selling at irrational rates.

Third, rate regulation can be used to promote solvency. Rate regulation and solvency regulation are generally viewed as being at cross purposes with each another. This is one argument that has been used against federal regulation of solvency: at least under state regulation, the same regulator has to deal with both rates and solvency, and so cannot regulate rates and ignore solvency considerations. Still, state insurance departments are not known for disapproving rates on the grounds that they are inadequate. Politically, it is difficult to explain to the public why the insurance commissioner has told companies to get their rates up. However, it can be done, and it is done in some states.

Fourth--and I admit this is a minor point--we regulators catch company errors. For example, a recent rate filing in Washington involved a 15% base rate reduction to account for a change in the base deductible. Unfortunately, the insurer applied the factor twice and printed rates that were 15% below what it intended. We caught that error before the rates were used. I presume the company would have caught it eventually, but I'm not sure when.

Trends in Rate Regulation

With the passage of Proposition 103 in California and growing consumer pressures in other states, it is no secret that the current trend is toward stricter regulation of rates. The arguments about the virtues of the free-market economy and the fall of communism in Eastern Europe seem to be falling on deaf ears.

I can tell you little that you don't already know about trends in regulation. But I do believe that trends will follow public perceptions. In fact--and unfortunate as this may be--they may be based more on appearances than on reality. Everybody thinks insurance costs too much--and will continue to think that, even if the friendly, local actuary can show that it's really a good deal. Everybody thinks insurance companies make too much money. And because the insurance business is so esoteric, the public assumes that companies are making even more money than what's reported in the newspaper. In states without significant rate regulation, there is a perception that nobody is protecting the consumer from being ripped off by the rich insurance companies. Insurance commissioners--and appointed ones often have close ties to the industry--are seen as industry lackeys. Recent scandals in several states have reinforced this view. And we could hope that few people saw the CNN report last year on the interaction between commissioners and the industry at NAIC meetings, but there are bound to be more reports like that.

In sum, truth often has some bearing on public perceptions, but the connection may be rather tenuous. In any case, it is the perceptions that will determine the future of rate regulation.

Key Questions for the Future

I would like to leave you with two key questions regarding the future of rate regulation.

First, how much rate regulation is the insurance industry willing to accept as good for it? In the context of the Persian Gulf war, we've heard references to "drawing a line in the sand." Exactly where will the insurance industry draw its line in the sand, and fight regulation only when the regulators cross that line?

I am beginning to understand that there may be many lines in the sand. The industry is not united on where to draw the line--how much regulation, and what form of regulation, is acceptable. For example, insurers are taking different positions on changes to the McCarran-Ferguson Act. Some may prefer federal regulation to state regulation--one gorilla instead of 50 monkeys, as the comparison goes. As one of the monkeys, I can understand that.

Everyone would recognize that it is good public relations for the industry to accept a modest amount of regulation. When the industry fights regulation that appears reasonable, it generates negative public opinion. But the question is how and when to translate this realization into company decisions.

I would like to use a recent controversy in Washington State as an example. Last December our insurance commissioner adopted a new regulation on property and casualty ratemaking. Under our prior approval system, the rule provides a framework in which insurers can show that their rates are not excessive, inadequate, or unfairly discriminatory.

The approach we took was to rely on the "Statement of Principles Regarding Property and Casualty Insurance Ratemaking," which the CAS adopted in 1988. If we started with something that actuaries agreed on, the opposition would, we hoped, be minimal. Our rule actually incorporates Principle No. 4 of the CAS document, which defines the standard that appears in most state rating laws as follows:

> A rate is reasonable and not excessive, inadequate, or unfairly discriminatory if it is an actuarially sound estimate of the expected value of all future costs associated with an individual risk transfer.

According to the CAS statement, "Such costs include claims, claim settlement expenses, operational and administrative expenses, and the cost of capital."

Our rule is flexible in that it does not prescribe a particular model to be used in determining an insurer's cost of capital. Nor does it set a maximum rate of return or range of returns. It lists several ways in which an insurer may establish its cost of capital or target return on equity. The insurer must then choose an underwriting profit provision that is consistent with its target return.

Faced with a regulation like this, the industry must ask: On which side of our line in the sand does this regulation lie? Should we accept it? Can we live with it? Should we fight it?

We found that companies drew very different lines in the sand. If we continue with the Persian Gulf analogy and liken the adoption of this regulation to Iraq's annexation of Kuwait--that's an unfortunate comparison, because the regulation is not _nearly_ so bad--we could say that some insurers drew the line to the south of Kuwait, and some to the north. The lines in the sand were that far apart! Several insurers supported the regulation, noting that it was actuarially sound and suggesting that it would streamline the rate approval process. A handful of insurers opposed the regulation in the belief that it was a clone of Proposition 103 and that the rate of return concept had no place in the rate review process.

Some elements of the insurance industry went so far as to propose legislation to overturn the rule. One proposal, for example, was a bill that would permit the insurance department to disapprove a rate, in a competitive market, only if the rate were found to be inadequate. "Excessive" and "unfairly discriminatory" would no longer be grounds for disapproval. Now regardless of whether such a system would be better or worse, the proposal was so patently one-sided that it quickly generated bad press for the industry. What do the insurance companies want? They want the commissioner to protect _them_ against inadequate rates, but the commissioner should not be allowed to protect the _public_ against excessive or unfairly discriminatory rates.

So where do you draw the line? How hard do you push for freedom from regulation? How much rate regulation is desirable as a safeguard against the more onerous regulation that can arise from a consumer revolt?

The second--and last--"key" question I would like to leave with you is more of a short-term issue--but it could be a long-term problem, if the industry's rate cycles continue unabated:

How disruptive will the next hard market be? We all believe the hard market is coming, but we don't know exactly when. The industry has yet to live down the tarnishing of its image that resulted from the last hard market. People still talk about the liability insurance crisis of the mid-1980's. I would suggest to you that, if the next hard market is anything like the last one, the cry for stricter regulation of rates will be renewed with more vigor and more public support than ever before.

Conclusion

Before I conclude my comments, let me say that I believe that increased use of actuaries--both consultants and state employees--will continue to be one aspect of the changing regulatory environment. Regulators will be seeking more information from company actuaries, as well. Actuaries have the skills to perform analyses upon which regulators can base reasonable decisions. We actuaries can make valuable and sensible contributions to public policy discussions relating to regulation. We must be willing to step forward and participate.

PUBLICLY RUN AUTOMOBILE PROGRAMMES IN CANADA (SEMINAR ON RATEMAKING, 3/91)

Barb Addie

The Canadian automobile insurance business is quite different from the U.S. in that 40% of the provinces have direct involvement in the administration of the business. In this presentation, I will explore the various public plans in effect and take a look at the available financial results.

The first public plan in Canada was established in 1944 in Saskatchewan, a western prairie province. In 1946, responding to the fact that only 12% of motorists were insured, automobile insurance was made compulsory and the Saskatchewan Government Ins. Corporation (SGIC) was given monopoly status. It is known locally as the "Auto Fund". SGIC writes other lines of business in competition with private insurers.

The Manitoba plan, first established in 1971 is known as "Autopac". At that time, it covered only automobile. In 1974, its powers were extended to other lines of business and later that year Manitoba Public Insurance Corporation (MPIC) general insurance services started. The automobile book is run as a monopoly. The MPIC, which writes all other lines of business in competition with private insurers has suffered significant losses in the last few years, particularly in its assumed reinsurance book.

The Insurance Corporation of British Columbia opened its doors in March of 1974. It initially wrote all lines of business with automobile being a monopoly. In 1985, all of the lines with the exception of automobile were sold to a private interest. Automobile insurance in BC is commonly known as the 'Auto Plan'. ICBC had significant deficits in their first two years and required a bail out of $175 million in 1977 which has never been repaid. This is the equivalent of $408 million in 1990 dollars.

The province of Quebec instituted its plan in 1978. It is a hybrid system under which the government has monopoly control over the Bodily Injury portion while the property damage coverages remain in the hands of private insurers. The Government portion is commonly known as the 'Regie' which is short for the Regie de l'assurance automobile du Quebec

In all four cases, the take-overs were made after significant public discontent over increasing premium levels by left-leaning governments. There was no compensation to private insurers for the confiscation of their business and the government run operations do not pay income taxes.

The plans in the three western provinces are similar while the Quebec plan stands alone. In the western plans, there are no restrictions on the ability to sue. In addition to the tort remedies, specific no-faults benefits are provided which are deducted from tort recoveries. In both Manitoba and Saskatchewan, collision coverage is mandatory.

In theory, private insurers compete with the government run plans on optional and excess coverages. In practice, given the unlevel playing field, very little of this business is in the hands of private insurers.

I will not go into the details of the various coverages at this time although an exhibit showing the plans by province is included in the hand-out.

The situation in Quebec is quite different. Here the Government administers the bodily injury portion which is on a pure no-fault basis. There is no right to sue. The schedule of benefits covers pain and suffering as well as economic losses.

It is interesting to note that all of the public systems have more than one source of revenue. Perhaps this allows the various plans to lower the visibility of rate increases. In British Columbia, a bonus/malus type system is in effect with a few other factors, including the value of the vehicle, how it is used and where the vehicle is garaged. There are, in addition to the above, surcharges which are paid annually based on the penalty points accumulated on drivers licences. These surcharges range from $115 to $3,000.

Under the Saskatchewan plan, premiums are wholly dependent on the vehicle itself; its wheelbase, value, repairability and accident frequency. Driver surcharges are levied annually based on the drivers accident record and traffic convictions in the three years preceding renewal. Surcharges start at $100 for at-fault accident, and $25 for traffic convictions.

In Manitoba, the major criteria are vehicle make and model, geographic location and driving record. There is also a base charge of $35 on each drivers licence. The amount can be reduced by accumulating merit points which are earned for each year of accident free driving. Should a driver accumulate demerit points, additional premiums ranging from $150 to $999 are payable. At-fault accidents are surcharged from $250 to $750.

In these three plans, it would be interesting to find out if the surcharges for at-fault accidents and convictions are in fact overlapping leading to a subsidization of "good" drivers by "bad" drivers.

Quebec, with only Bodily Injury to cover, has a much simpler rating structure with $99 being charged for each private passenger vehicle. Different rates are charged for each class of vehicle. A fee of $25 annually is charged in addition to the normal driver licence fees.

Changes to the rates in all of the provinces is a very politically sensitive issue and has been responsible for the demise of more than one government. This is particulary true in the provinces which have retained the tort system. Government run plans have no more immunity from escalating judgements than do private insurers. It should be noted the Canadian policies generally have much higher limits than those sold in the US. The minimum amount countrywide, with the exception of Quebec, is $200,000 although approximately 41% have policies with ½ mill limits and more than 48% have limits of $1,000,000 or higher. At the same time, Canadians are less ligaceous then our brethren to the South.

The next few slides compare the results of the various public plans to the experience of the privately run system (currently) in Ontario. All loss adjustment expenses, including the unallocated position, have been included with the losses. It would seem reasonable that loss costs reflect the underlying system of compensation, traffic density, the degree of industrialization etc or essentially the costs which are outside the control of the insurer. Administrative expenses are under the control of the person delivering the service and hence form the most reasonable basis of comparison between private and public insurers. All of the numbers shown are for 1989 and earlier as more recent statistics are not available. The statistics available for public insurers are sparser than for private insurers as they are not required to report publically on their operations.

The loss costs shown on exhibit A are in line with what would be expected given the differences in the provinces. Only the Quebec result appears to be out of line and this can be attributed to system of pure no fault in that province. The loss ratios are very high for both the public and private plans showing heavy dependence on investment income. The results in
Ontario are distorted by the fact that rates have been essentially frozen since 1987. The premiums are lower than their US counterparts which reflect primarily the differences in the judicial systems and peoples expectations of the judicial systems in the two countries.

The second exhibit displays the expense results. The public plans in the rural prairie provinces show significant savings over the privately run systems. The biggest difference are in the cost of distributing the product. I think that there can be little doubt that the current cost of distributing what has become a basic commodity is too high. The consumer does not appear to get a reasonable return on his investment. The Quebec number shown is somewhat overstated. This is because the unallocated claims expenses could not be fully segregated based on the available information on the administrative expenses. However, there can be little doubt that some of the savings on the loss side, when moving from a tort based system to a pure no-fault approach, must go to the administration of the no-fault system. The results in British Columbia would tend to indicate that a large publically run plan with significant urban exposure does not necessarily lead to expense savings suggested by many proponents of publically run automobile insurance.

The third exhibit shows the vehicles handled per employee. Once again the rural provinces show a distinct advantage. The hybrid system in Quebec appears to be very labour intensive. It is difficult to say if this is as a function of the system or the culture within which it operates. Most likely it is a function of both.

On the fourth exhibit, the percentage changes in average premium per vehicle are shown. The Ontario premiums have been frozen and do not form a reasonable basis for comparison. As stated earlier, public systems are not immune to increases in losses. There have been significant increases, particularly in Manitoba and British Columbia. The rates in Quebec have been quite stable. In fact, the public portion of the premium decreased by 14% in 1987 and has not changed since that time.

It should also be noted that the public insurance systems enjoy a considerable degree of public support. Even after the left leaning governments have been replaced by administration more favourable to business, the public systems have not reverted into private hands. This is at least partially due to the tremendous start-up costs and the loss of public servant positions but it must also be admitted that the public is not, on the whole, displeased with the corporations. There are expense savings, particularly in rural settings, but these are not shared equally by all insureds. The significant amount of cross subsidization inherent in all government run plans means that low risk drivers do not accrue the same levels of savings as high risk drivers. There is also evidence that flat-rated systems, such as that in place in Quebec, actually increases accident frequencies as high-risk drivers who could previously not afford to drive are now on the road. This is particularly true of young drivers.

In summary, 40% of Canadian provinces have some form of publically run automobile insurance. (This is likely to become 50% very soon). The publically run systems, particularly in rural areas, do appear to generate expense savings. However, the magnitude of the savings is less clear for larger, more urbanized provinces. The publically run plans are not immune to increases in losses although the ability to increase rates is very politicized and this can lead to subsidization of the automobile user by the general tax payer.

EXHIBIT 1

COMPARISON OF RESULTS

** 1989 **

PROVINCE	NUMBER OF VEHICLES (000's)	EARNED# PREMIUM (000,000's)	AVERAGE PREMIUM	INSURED LOSSES (000,000's)	AVERAGE LOSS PER CAR	LOSS RATIO
BRITISH COLUMBIA[1]	2,200	1,245.8	566	1,229.4	559	98.7
SASKATCHEWAN[2]	804	238.8	297	212.0	264	88.9
MANITOBA[2]	720	292.1	406	279.7	388	95.6
ONTARIO[3]	5,300	3,786.0	714	3,730.0	704	98.6
QUEBEC[4]	3,840	2,085.2	543	1,824.0	475	87.5

INCLUDES ADDITIONAL SOURCES OF INCOME, EXCLUDING INVESTMENT INCOME

SOURCES OF DATA

(1) ICBC ANNUAL REPORT

(2) CANADIAN INSURANCE, 1990 STATISTICAL REVIEW

(3) IBC SPECIAL CALL FOR DATA

(4) REGRE ANNUAL REPORT AND ANNUAL INSURANCE STATISTICAL REPORT (GAA)

EXHIBIT 2

COMPARISON OF RESULTS

** 1989 **

PROVINCE	NUMBER OF VEHICLES	EXPENSE RATIO			EXPENSES/ VEHICLE
		GENERAL OPERATING	COMMISSIONS	TOTAL	
BRITISH COLUMBIA	2,200	16.4	6.8	23.2	131
SASKATCHEWAN	804	15.6	2.1	17.7	52
MANITOBA	720	14.5	5.1	19.6	80
ONTARIO	5,300	12.9	10.6	23.5	168
QUEBEC	3,840	17.5	8.7	26.2	142
QUEBEC - PUBLIC		29.6	1.9	31.5	
QUEBEC - PRIVATE		13.5	10.9	24.4	

EXHIBIT 3

** 1989 **

	VEHICLES/ EMPLOYEE (WITHOUT BROKERS)	VEHICLES/ EMPLOYEE (WITH BROKERS)
BRITISH COLUMBIA	579	466
SASKATCHEWAN	894	627
MANITOBA	655	480
ONTARIO* +	474	239
QUEBEC*	384	209

* ONLY TOTAL EMPLOYMENT NUMBERS WERE AVAILABLE FOR ONTARIO AND THE PRIVATELY RUN PORTION OF THE QUEBEC PLAN. IT HAS BEEN ASSUMED THAT 50% OF THE TOTAL EMPLOYMENT IN ONTARIO RELATES TO AUTOMOBILE WHILE THE COMPARABLE NUMBER IN QUEBEC IS 46%.

\+ THE ONTARIO NUMBERS ARE OVERSTATED AS THE MAJORITY OF HEAD OFFICES ARE SITUATED IN ONTARIO AND PART OF THESE EMPLOYEES TIME IS SPENT ON OTHER PARTS OF THE COUNTRY.

EXHIBIT 4

RATE LEVEL CHANGES

	NUMBER OF VEHICLES (000'S)	AVERAGE PREMIUM	PERCENTAGE CHARGE	LOSS RATIO
SASKATCHEWAN				
1988	755	292	7.0	102.7
1987	735	273	10.5	115.6
1986	778	247		104.4
MANITOBA				
1988	770	363	18.8	93.4
1987	777	306	8.1	129.0
1986	759	283		113.7
BRITISH COLUMBIA				
1988	2,350	440	22.6	101.0
1987	2,291	359	5.3	113.1
1986	2,223	341		107.3
QUEBEC				
1988	3,432	566	9.3	N/A
1987	3,317	518	6.1	N/A
1986	3,145	488		N/A

SELECTED AUTOMOBILE INSURANCE PLANS IN CANADA

Province	Who Administers the System	System of Compensating Accident Victims	Number of Vehicles	How Product Is Sold	Industry Employment	Rating Factors	Other Sources of Revenue
British Columbia	Government-run. Insurance Corporation of British Columbia (ICBC) has exclusive right to sell compulsory coverages. Car insurance program is called "Autoplan." Private sector sells amounts above compulsory limits and optional coverages such as collision and comprehensive insurance.	Tort (the ability to sue for compensation) plus prescribed "no-fault" benefits.	2.2 million	Independent brokers.	3,800 at ICBC; 918 independent brokers.	Drivers pay premiums on a set scale specifically related to their claims experience. Other factors include value of vehicle, how it is used and geographic location. Age, sex and marital status do not apply.	Surcharge premiums (varying from $115 to $3,000) are paid annually on penalty points accumulated on drivers' licences.
Saskatchewan	Government-run. Saskatchewan Government Insurance (SGI) has exclusive right to sell compulsory coverages. Car insurance is referred to as the "Auto Fund." Collision insurance is compulsory. Private sector sells amounts above compulsory limits and optional coverages such as comprehensive insurance.	Tort (the ability to sue for compensation) plus prescribed "no-fault" benefits.	804,296	Compulsory insurance is included in price of vehicle registration, which is issued by SGI office staff and independent insurance agents authorized by SGI to issue motor vehicle registrations and drivers' licences.	Approximately 900 at SGI; 384 licenced agents.	Premiums depend wholly on the vehicle – its wheelbase, value, repairability and accident frequency.	Driver surcharges are levied annually, based on accident record and traffic convictions during the three-year period preceding renewal. Surcharges start at $100 for each at-fault accident, and $25 for traffic convictions.
Manitoba	Government-run. Manitoba Public Insurance Corporation (MPIC) has exclusive right to sell compulsory coverages. Also sells extension coverages in competition with private sector. Car insurance program is called "Autopac." Collision insurance is compulsory. Private sector sells amounts above compulsory limits and optional coverages such as collision and comprehensive insurance.	Tort (the ability to sue for compensation) plus prescribed "no-fault" benefits.	720,000	Independent brokers authorized by MPIC; staff in Driver and Vehicle Licencing and MPIC offices.	Total employees (all insurance lines): 1,100 at MPIC; 400 Autopac brokers.	Major criteria are vehicle make and model, use, geographic location and driving record. Age, sex and marital status do not apply.	Basic $35 premium on each driver's licence. This can be reduced by accumulating merit points earned with each year of accident-free driving. Demerit point premiums ranging from $150 to $999 are paid annually when drivers' licences are renewed. At-fault accidents are surcharged from $250 to $750.

SELECTED AUTOMOBILE INSURANCE PLANS IN CANADA
(Continued)

Province	Who Administers the System	System of Compensating Accident Victims	Number of Vehicles	How Product Is Sold	Industry Employment	Rating Factors	Other Sources of Revenue
Ontario	Private sector. Car insurance program is called Ontario Motorist Protection Plan. Most aspects are regulated by the Ontario Insurance Commission.	Partial no-fault. Accident victims are compensated by prescribed no-fault benefits to cover economic losses. Lawsuits for additional compensation are restricted to people with serious permanent injury or in the event of death.	5.3 million	*Independent brokers and company agents.*	Total employment (all insurance lines): 20,000 company staff; 22,000 brokers; 2,360 adjusters.	Age, sex, marital status, accident and driving record; vehicle model and use; mileage; geographic location.	None.
Quebec	Run jointly by Private and Public Sectors. Government: La Société de l'Assurance Automobile du Québec has exclusive right to provide compulsory accident benefits (bodily injury) coverage.	Pure no-fault. Victims receive prescribed no-fault benefits. There are no lawsuits. Schedule of benefits covers pain and suffering as well as economic losses.	3.84 million	Bodily injury insurance is included in cost of vehicle registration. Fees are collected through vehicle registration by government employees.	2,380 at La Société.	Everyone pays the same. The fee for private passenger vehicles was $99 in 1990. Different rates are charged for taxis, buses, trucks, etc.	$25 annual fee on drivers' licences is paid by all drivers.
	Private Sector: Companies provide optional vehicle damage insurance, compulsory 3rd party liability coverages plus additional accident benefits.	Without collision coverage, vehicle damage claims are paid by the vehicle owner's insurance company to the extent the driver was not at fault in the accident.		Property damage insurance is sold by independent brokers and company agents.	Total employment (all insurance lines): 14,300 company employees; 18,150 agents and brokers; 2,250 adjusters.	Age, sex, marital status, driving and accident records of drivers; vehicle and use; mileage; geographic location.	None.

Canadian Automobile Insurance Plans – Coverage for Private Passenger Automobiles

- Alberta, Ontario and Manitoba residents involved in accidents in Quebec receive from their own insurer the equivalent to the benefits available to Quebec residents from the government of Quebec
- Accident Benefits Coverage is compulsory except in Newfoundland.
- Collision Insurance is optional except in Manitoba ($350 All Perils deductible) and Saskatchewan ($500 deductible)

	Nfld.	Que.	N.S./N.B./P.E.I.	Man.	Sask.	Alta./Yukon	B.C.	N.W.T.
THIRD PARTY LIABILITY (BODILY INJURY AND PROPERTY DAMAGE) COMPULSORY IN ALL PROVINCES								
	Minimum $200,000	**Minimum $50,000** No Exposure to Bodily Injury within Quebec	**Minimum $200,000**	**Minimum $200,000**	**Minimum $200,000**	**Minimum $200,000**	**Minimum $200,000**	**Minimum $200,000**
MEDICAL PAYMENTS								
	$2000 per person excluding amounts under government medical & hospital plans **Time Limit: 2 years**	No time or amount limit Includes rehabilitation	$25,000 per person including rehabilitation, excluding government health insurance plans **Time Limit: 4 years**	$100,000 per person excluding compulsory health insurance scheme	$10,000 per person discretionary to meet expenses.	$5000 per person including rehabilitation, excluding amounts under Government Medical & Hospital Plans Alta.—chiropractors $500 per person per occurrence	$100,000 per person subject to third party limit, includes rehabilitation, excludes any amounts payable under surgical, dental, hospital plan or other insurer	$25,000 per person excluding amounts under government medical & hospital plans **Time Limit: 4 years**
FUNERAL EXPENSE BENEFITS								
	$500 maximum	**$2914.99 maximum**	**$1000 maximum**	**$2500 maximum**	**None**	**$1000 maximum**	**$1000 maximum**	**$1000 maximum**
DISABILITY INCOME BENEFITS								
	$35.00 per week 104 weeks temporary + 104 weeks permanent 7 day waiting period Housewife $12.50 per week **Max. 12 weeks**	**Min. $170.97 per week or 90% of net wages** Max. Income Gross $38,000 per year Temporary - 5 years Permanent - lifetime 7 day waiting period **Indexed**	**80% of Gross Wages** Max. $140.00 weekly 104 weeks temporary + Lifetime total & permanent Ont. — first day cover N.S., N.B., & P.E.I. — 7 day waiting period *Unpaid housekeeper $70.00 per week* **Max. 12 weeks**	**$150.00 per week or 70% of Gross Wages** Max. $300.00 weekly 104 weeks partial @ $60.00 7 day waiting period Homemaker Total $150.00 weekly Partial $60.00 weekly ***Max. 104 weeks***	**$150 per week** *Lifetime Total* 104 weeks partial @ $75.00 7 day waiting period Housewife $150.00 weekly—Total $ 75.00 weekly—Partial **Max: 104 weeks.**	**80% Gross Wages** *Max. $150.00 weekly* Yukon—Min. $40.00 weekly 104 weeks temporary or total 7 day waiting period **Yukon**—Housewife $75.00 per week **Alta.**—Spouse $50.00 per week **Max. 26 weeks**	**75% Gross Wages** *Max. $145.00 weekly* 104 weeks temporary + Lifetime total & permanent 7 day waiting period Homemaker $145.00 per week **To Age 65**	**Employed Person** **80% Gross Wages** Max. $140.00 weekly 104 weeks temporary 7 day waiting period Unpaid Housekeeper $100.00 per week **Max. 12 weeks**
DEATH BENEFITS								
	Death within 3 months after accident Married Male Age Limits: 10-59 $5000 • 60-69 $3000 • 70+ $2000 plus $1000 each dependent child •No limit Married Female Age Limits: 10-59 $2500 •60-69 $1500 • 70+ $1000 *Unmarried Person living* with parents: Scale by age **Maximum $2500**	**Death anytime after accident** Indexed pension to dependent survivors based on Disability Income Benefits of deceased. Min. $170.97 per week Without dependent $8744.96 or $4372.48	**Death within 2 years after accident** Head of Household Age Limits: None $10,000 plus $1000 each dependent beyond first No limit Spouse *No age limit*: $10,000 Dependent Child: $2000	**Death anytime as a result of accident** Age Limits: None $10,000 to the primary dependent **and** $2,000 to each secondary dependent (no limit) Dependent Spouse: $10,000 Dependent *Child*: $2,000	**Death within 2 years after accident** $10,000 to primary dependents **plus** $1500 each secondary dependent Spouse No age limit: $2500 Equal division to surviving dependents Dependent Child: $2500	**Death anytime after accident** Head of Household $5000 **plus** $1000 for each dependent beyond first + 1% of Total Principal Sum for 104 weeks. No Limit Spouse $5000 *Dependent Child* Scale by age **Maximum $1600**	**Death anytime after accident** Head of Household $5000 + $145.00 Weekly for 104 weeks to first survivor **plus** $1000 + $35.00 weekly for 104 weeks for each survivor beyond the first. No limit Spouse $2500 Dependent Child Scale by age **Maximum $1800**	**Death within 2 years after accident** Head of Household Age Limits: None $10,000 Spouse Age Limit: None $10,000 plus $2500 for each survivor other than the first One survivor—spouse or dependent principal sum increased to $1500 **No limit**
DISMEMBERMENT BENEFITS								
	Schedule based on 50%-100% of Principal Sum	Scheduled up to $42,743.06	Not included. Becomes part of other recovery	Impairment occurring within 90 days $20,000 *Deducted from deathbenefits.*	Scheduled Benefits **Maximum $10,000**	Not included. Becomes part of other recovery	Not included. Becomes part of other recovery	Not included. Becomes part of other recovery
ADMINISTRATION								
	Private Insurers	Government – bodily injury Private Insurers – property damage	Private insurers	Compulsory Insurance – Government Monopoly Optional and Excess – Government and Private *Insurers compete*	Compulsory Insurance – Government Monopoly Optional and Excess – Government and Private *Insurers compete*	Private Insurers	Compulsory Insurance – Government Monopoly Optional and Excess – Government and Private *Insurers compete*	Private insurers

*Changes in Ontario are under discussion at time of printing.

The Ontario Motorist Protection Plan Guaranteed Accident Benefits

ACCIDENT BENEFITS	CURRENT LEVEL	NEW PLAN LEVEL	PER CENT INCREASE
INCOME REPLACEMENT			
.. Employed	$140/week for 104 weeks unless totally disabled	$600/week cap 80% of gross income for 3 years or life if totally disabled	+329% (plus extended time)
.. Deemed Employed (worked 6 months in past 12)	As above	As above	As above
.. Students	None	$185/week for 3 years or life	N/A
.. Unemployed	None	$185/week (as above)	N/A
.. Retirees	None	$185/week (as above)	N/A
.. Unpaid Homemakers	$70/week for 12 wks if totally disabled	$185/week (as above)	+164% (plus extended time and wider entitlement)
Child Care Benefit	None	$50 per child maximum $200/week	N/A
Supplementary Medical Care and Rehabilitation	$25,000 with 4-yr limit	$500,000 with 10-yr limit or 20 yrs less victim's age	+1900% (plus extended time)
Long-term Care	N/A	$500,000	N/A
Death Benefit .. Death of Head of household or Spouse	$10,000	$25,000	+150%
.. Death of Dependent	$2,000	$10 000	+400%
Funeral Benefit	$1,000	$3,000	+200%

NOTE: ** Guaranteed benefits to be reviewed at least every two years.

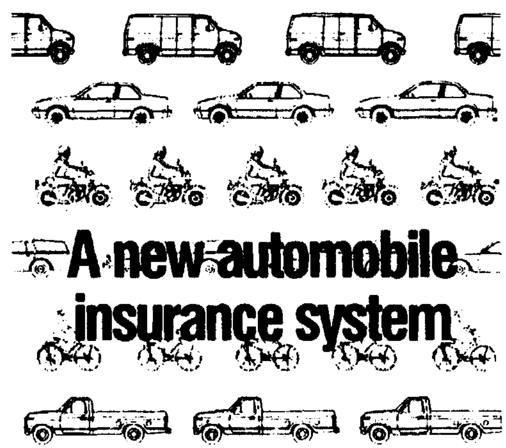
If you require more information
or have any specific questions
about your insurance policy,
contact your insurance agent or broker.

Ontario Insurance Commission

Ontario Insurance Commission
4th Floor, 5 Park Home Ave.
North York, Ontario
M2N 6L4

67500E

The Ontario Motorist Protection Plan



Ontario Insurance Commission

CHART OF INDEMNITIES

Indexation:

The basic amounts used for the calculation of the indemnities are indexed annually on January 1 (s. 83.33 to s. 83.40).

January 1, 1991

Adjusting Factor: 1.048

Income Replacement:

"Employed" as defined: full time, temporary or part-time employment.

Maximum Admissible Income: $42,000
Minimum: minimum wage.
Annual Average Income: $25,321

No Income:

Students: From $3,144 to $11,528 per year.
Non-employed: long term disability only.

Death Benefits: Lump Sum

Spouses:	Maximum:	$209,600
	Minimum:	$41,920
Dependants:	Maximum:	$36,680
	Minimum:	$19,912

Disabled Dependant: additional $17,292

No Surviving Spouse or Dependant: $15,720 to Parents.

Funeral Expenses: $3,144

Personal Assistance and Care Expenses:

From $79 to $524 per week.

Supplementary Medical, Rehabilitation and Care Benefits:

No aggregate limit.

Non-Pecuniary Damages:

From $524 to $100,000

STATE REGULATION OF INSURANCE: ITS OWN WORST ENEMY – REVISITED (SEMINAR ON PROFITABILITY, 4/91)

George K. Bernstein

The purpose of the seminar that you have been attending is essential: to provide an overview of total rate of return methodologies so that actuaries will be better able to understand how those methodologies relate to pricing.

It is not my intent today to engage in an analysis of the methodology, other than to observe that the implications of its application to a free market system are overwhelming.

It is my intent to discuss the politics of state insurance regulation that created and drive that methodology.

The use of rate of return by state regulators is an example of why efforts are underway in Washington that involve exploration of a greater federal role in insurance regulation, and preemption of certain aspects of state regulation.

In preparing my talk, I looked back at some of what I previously said about state regulation and federal alternatives. Comments and observations that I made as far back as 15 years ago seem worth repeating.

In 1979, right here in South Carolina, in a talk entitled "State Regulation of Insurance: Its Own Worst Enemy", I expressed my concern that:

> "Too frequently, state regulators, rather than responding to the substance of a federal contention that greater control over insurance is needed, try to prove that they can be tougher on the industry than the federal government.

"As a result, the merits of certain issues -- whether prior approval or competitive rating is a more efficient and equitable approach to insurance pricing, or whether cost-based pricing or rate equalization is more appropriate to private insurance system -- are not addressed, but rather the states seek to preempt federal attention by doing whatever the federal government is considering, and more so, before the 'feds' do it, regardless of whether that something is right or wrong."

I concluded that:

"Artificial rate ceilings, compulsion, uniformity and subsidy belie the 'claimed advantages' of state regulation. Firm regulation to assure fairness and protection is necessary and desirable. Defensive overregulation is neither in the interest of the industry nor of insurance consumers generally. If state regulators fail to distinguish between essential insurance principles and intuitive theories of cost equalization and do not begin to educate the public they represent on the implications of the difference, a profit motivated, private insurance system will not survive.

"We may not yet have reached the stage where insurers and others have nothing to lose by a change in regulatory forum, but it is not too soon to consider the alternatives."

Earlier, in an article in the April 1976 Best's Review, I went into some detail as to factors that might impel endorsement of a federal alternative to state regulation of insurance.

"The current quality of regulation in many states is so uncertain at best that without a basic change by the states in their regulatory direction, the future of the industry is in peril.

"The concern I express goes far deeper than to the lack of regulatory leadership that is necessary to produce stability in a regulated industry. It transcends the unhappy myopia through which states divert all but a small fraction of premium tax receipts to general revenue purposes, leaving insurance departments underfunded, understaffed and overdependent for technical expertise on the industry they are supposed to regulate. Perhaps this dependence is partially responsible for the defensiveness of many insurance departments in their unwillingness to take action, however proper and necessary, if insurers would appear to be the primary beneficiaries. Certainly, the short tenure of commissioners -- said to average less than two years -- accounts in some measure for the less than professional performance of some insurance departments.

* * *

"[I]n conjunction with social developments of recent years, these regulatory shortcomings have produced an operating climate under which no industry can prosper and continue to perform those services which brought it into being."

* * *

"It is, apparently, far easier for legislatures to require insurers to make their product available than to address the underlying cancers which produced the price or availability problem."

* * *

"Nevertheless, it is the insurance industry that receives the public blame for the resultant increases in insurance premiums, and which is increasingly called upon to make its product available without regard to the risk assumed. It would not seem likely that this trend will be reversed, and like it or not, the industry will continue to be called upon, by statute, to sell insurance it does not wish to market, to risks that may not be insurable."

* * *

"What is occurring, however, in too many states and in too many lines of insurance, is political rather than regulatory reaction to applications for rate relief. Judging by results, the first question asked by too many insurance departments is not 'is the filing accurate?' but 'how will the legislature and the public react to an increase in premiums?' Public hearings are held, speeches are made, postures are taken, and the ultimate standard of performance is who denounced the insurance industry most vigorously."

* * *

"I recall that when we urged an end to prior approval in New York State, in 1969, we cited the unworkability of a ratemaking mechanism which by its very nature dictated that by the time rates were finally approved, they would be outmoded and probably inadequate. We cited the waste of regulatory time and manpower, which could better be put to other uses. We delicately alluded to the existence of political pressures on the regulator, being careful not to overemphasize this potentially embarrassing aspect of the issue. Certainly in the National Association of Insurance Commissioners and in various state legislative debates, the issue of political ratemaking inherent in prior approval was always carefully skirted.

"The movement toward open competition at the state level has, unfortunately, come to a standstill."

* * *

"[I]t should, therefore, be no surprise that coming off a year which produced more than a $4 billion property/liability underwriting loss, many carriers that previously would have rejected any talk of even the most minute intrusion by the federal government are at least listening with interest to the proposals now being discussed in Washington. Faced with an increasing number of insurer insolvencies in the last few years, unable to obtain timely rate relief in prior approval states, and pessimistic about the likelihood of those states changing to an open competition mode, it is not surprising that insurers are questioning many basic tenets of regulation -- many for the first time.

"Adding fuel to the debate is the irony that what emerged in the last decade as an acclaimed solution to the incidence of insurer default -- insolvency funds -- have, in fact, insulated, at least temporarily, many regulators and legislators from the ultimate realities of rate inadequacy. Some insurance departments act as though the existence of insolvency funds permits depression of rates below adequate levels, because in the event of default, the policyholder will be protected. This dangerous game requires acceptance of the delusion that the whole is not equal to the sum of its parts. It overlooks the fact that someone has to pay for insolvencies, and where such funds are available, the cost is merely shifted to still solvent carriers. Theoretically, the cost is then passed on to policyholders of the solvent insurers, but in practice this does not occur to the extent that rates are artifically held down in prior approval states. Where the cost of the carrier's share of the insolvency is not recouped through rate increases, a drain on the surplus and capital of the carrier must occur.

"However elementary this logic, it does not seem to be sufficiently appreciated by the public, its legislators or even by regulators. Insolvency funds, even if they are not depleted by legislatures for general revenue purposes, are not cornucopias, and without adequate rates a cycle of insurer insolvencies is a certainty."

* * *

"In 1962, the Assistant Attorney General in charge of the Antitrust Division, following the O'Mahoney Senate Antitrust and Monopoly Subcommittee hearings, endorsed the Kefauver bill which would have mandated an open competition rating law for property and liability insurance lines in the District of Columbia. Similarly, the Justice Department, in 1966, unsuccessfully intervened in a North Carolina lawsuit seeking to overturn that state's mandatory bureau rate system. Since that time, numerous Justice Department spokesmen have endorsed the principles of competitive rating laws as more compatible with antitrust principles than a regulated approach. Rate regulation may be appropriate in a public utility or monopolistic or oligopolistic context, but it has no merit when applied to a competitive industry like insurance with low concentration and relative ease of entry."

* * *

"There are undoubtedly a few carriers which, if given the choice, would opt for an exclusive federal regulatory system. Regardless of the merits of such an approach, its chances of realization in the foreseeable future are minimal -- absent a total breakdown in state regulation for solvency and widespread financial disasters within the industry. But while it will probably take catastrophes of a monumental nature to shift the balance of political power so drastically from the extant state systems, the very shortsightedness that permits arbitrary rate suppression could actually produce the scale of insolvencies that could bring down state regulation."

* * *

"[I]t is not likely that the commitment of insurers to state regulation is such that they can afford to ignore the interests of their policyholders and stockholders and fail to react to the treatment they are receiving in many states. Neither the principles of insurance regulation nor those of corporate responsibility contemplate economic suicide."

That was 15 years ago. It is hard to see what has changed for the better. The breakdown in state regulation that may be the precusor of federal regulation may be occurring.

Both the incidence and size of insolvencies has increased; markets, including commercial, have become less free; rates continue to be depressed based on political considerations; cross subsidization has increased; residual market shares have grown; the most competitive and one of the most attractive markets in the country -- California -- has been all but destroyed; and insurers are withdrawing from a growing number of states.

As increasing attention was given to public utility treatment of a competitive industry and "rate of return" supplanted cost based pricing, regulators lost sight of their <u>raison d'être</u> -- solvency regulation.

In any competitive market, players will fail, but when the insolvencies of just five insurers that became insolvent in the last few years account for a minimum of $4 billion, something is very wrong.

The overwhelming number of large recent insolvencies has not occurred in states with small insurance departments and inadequate resources, but in those with extensive expertise and reputations to match.

Some of these insolvencies can be attributed to the reckless competition of the late seventies and early eighties, some to unanticipated losses compounded by expanded legal theories of recovery, and some to negligent and even fraudulent management. But none occurred overnight, and the contributing factors are within the scope of what regulation is all about.

Each failure evolved under statutorily imposed regulatory regimes that were designed to prevent or promptly identify insolvencies and involved repeated review of annual statements and hands-on examinations by both domestic and foreign state regulators. Most of the significant insolvencies involved highly capitalized insurers who were licensed countrywide and who were covered by guaranty funds.

All insolvencies cannot be prevented. But those that occur must be responded to timely and losses must be contained.

The National Association of Insurance Commissioners has taken major strides in the last two years to improve the tools available to regulators. But lack of tools, financial resources and awareness of the troubled status of insurers has not been why state action on insolvencies has been too little, too late.

The major reason has been lack of regulatory will. Regulation is a very personal process. All the statutes, regulations and penalties are useless unless the regulator is willing to use them. The tendency of insurance commissioners to treat any insolvency as a personal failure and their willingness to indulge unrealistic hopes of recovery are exacerbated by the existence of guaranty funds. Because of these funds, which serve an important function for small policyholders, the regulator acts as if delay has no cost. The error of this belief is obscured by the time lag in receipt of the bill. Given the notoriously short terms of most commissioners, they will be long gone when payment comes due.

Any response to insolvencies that does not address the human nature of the regulatory dilemna will fail. Incentives must be created that put a greater penalty on delay than on prompt acknowledgement and action. One such incentive is to require domestic commissioners to annually rate insurers for relative solidity. If Best's can do it, so can the regulator charged by statute with solvency oversight. Unfortunately, reluctance to assume public responsibility for evaluating an insurer's solvency seems even greater than reluctance to act once the insolvency occurs.

The failure of state regulation to effectively manage its primary function -- solvency oversight -- may be the most significant factor that distinguishes current discontent with state regulation from that 15 years ago. Although the intensified politicalization of pricing and the presumptuousness of insurance departments in substituting their view of what coverage and terms they will permit to be negotiated between insurers and sophisticated business is fomenting increased disallegiance to state regulation, the interest in Washington in solvency may be what pushes some federal preemption over the top.

Several years of Congressional investigation of insurer insolvencies and the inadequacy of state response will, no doubt, result in legislative proposals to impose a federal role. Dual regulation being the *bête noire* of almost every insurer, the response may well be an endorsement of federal preemption, not just of solvency regulation but of all regulation of commercial insurers.

The extent of use of non-authorized offshore insurers, that fuels so much of Washington's concerns, is directly related to the interference by state insurance regulators with the commercial marketplace. The concern by U.S. insurers about their loss of business to offshore competition creates a natural fit with Congressional solvency concerns. Insurers who once were wedded to the sanctity of state regulation of insurance are finding economic concerns more compelling than ideology.

The most manifest demonstration of this fit is the growing effort to explore legislation that will establish effective federal solvency regulation and authorize federal chartering of commercial property/casualty insurers.

Under this approach, the regulatory focus of the federal regulatory entity will be on solvencv, without the distraction of price and form oversight and without the counterproductive presence of guaranty funds. The absence of guaranty funds will deprive the federal regulator of the luxury of someone else -- taxpayers or other insurers -- picking up the costs of its shortcomings. Unlike current state regulation with its guaranty funds and unlike federal banking regulation with its FDIC and FSLIC bailouts, the full burden and onus of solvency regulation will be on the regulator.

By their refusal to define and defend the free market necessary to a competitive insurance industry, the states may have succeeded in dissipating the once fervent support for state regulation of insurance. The opportunity for sound solvency regulation at ~~of~~ the federal level may finally provide the catalyst for industry support of a comprehensive program of federal solvency regulation, federal chartering of large commercial insurers and preemption for those insurers of all state regulation.

INSURER MODELS: A SAMPLE (SEMINAR ON PROFITABILITY, 4/91)

Robert P. Butsic

CAS SEMINAR ON PROFITABILITY
April 15-16, 1991

Insurer Models: a Sample

The Fireman's Fund Approach

Robert P. Butsic

- **Integrated method of Fireman's Fund**
  - Key concern is treatment of risk
  - Ratemaking and Valuation must be consistent
  - Capital requirements based on risk of balance-sheet items
  - Price depends on risk (loss discounted at risk-adjusted yield)
  - Balance sheet valuation depends on price (economic value of losses)

- **Exhibit 1: How the risk adjustment works**
  - Shows relationship between balance sheet values and price
  - Asset return equals weighted average return of equity and reserves

- **Economic value accounting**
  - Balance sheet items are valued at their worth in a market exchange
  - Assets valued at market
  - Liabilities (reserves) discounted to market (present) value
  - Reserve value includes price of risk
  - Consistency requires capital value = MV(assets) - MV(liabilities)
  - Statutory surplus irrelevant?

- **Exhibit 2: Separation of investment and insurance operations**
  - Capital requirements for assets & reserves
  - Investment operation acts as a bank
  - Insurance operation gets riskless yield on its cash
  - No further need to consider asset risk in pricing

- **Key assumptions of pricing model**
  - Riskless yield (duration-matched Treasury notes)
  - Risk adjustment (derived from historical data)
  - Income taxes built into pretax risk adjustment
  - Projected cash flows by product line

- ❑ **Exhibit 3: Pricing model applied to a typical product line**
  - ➡ Illustrative example using hypothetical values
  - ➡ Risk varies by reserve category (UPR, IBNR, Case)
  - ➡ Target combined ratio (Page 1) uses appropriate risk adjustment
  - ➡ Breakeven combined ratio (Page 2) uses zero risk adjustment

- ❑ **Exhibit 4: Return on equity for a profit center**
  - ➡ Implementation of integrated pricing, valuation and profit measurement system
  - ➡ Target accident-year combined ratio is output of pricing model
  - ➡ "Breakeven" combined ratio also computed
  - ➡ Actual rate of return in profit center derived from these ("boxed" area in Exhibit)
  - ➡ No need for balance sheet at profit center level

- ❑ **Extensions of pricing model**
  - ➡ Risk adjustment variation by line (Surety, Earthquake)
  - ➡ Credit risk (negative risk adjustment)
  - ➡ Ceded reinsurance
  - ➡ Servicing carrier & involuntary insurance

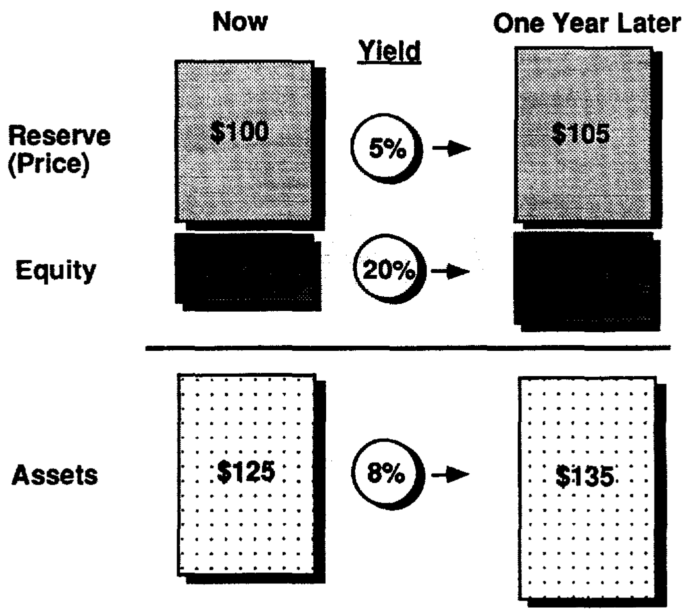
- ❑ **Practical problems with model & applications**
  - ➡ Explaining method & concepts to users (in-house & regulators)
  - ➡ Fixing the riskless yield in advance of plans
  - ➡ Relying on underwriting areas to furnish cash flow data
  - ➡ Not all cash data are available or easy to analyze
  - ➡ Indicated rate may not "sell" (may be suboptimal)

Exhibit 1

HOW THE RISK ADJUSTMENT WORKS: A NUMERICAL EXAMPLE

Required Equity	25%	of Discounted Reserves
Required Return on Equity	20%	Pretax
Yield Rate	8%	Riskless
Paid Loss	$105	Paid One Year Later

What Price (Discounted Loss) Matches These Assumptions?



Yield Rate Relationship: 8% = [5% (100) + 20% (25)] / 125

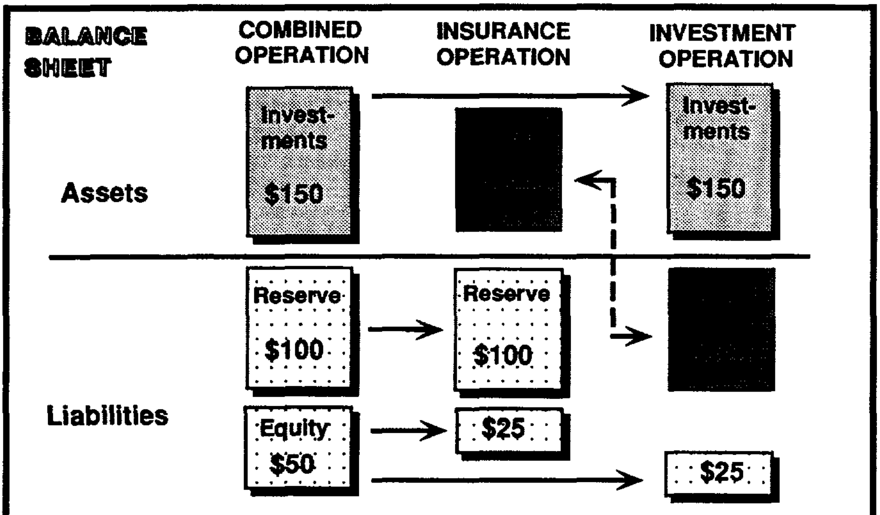
Risk Adjustment = Profit Provision = (8% - 5%) = 3%

Formula is 3% = .25 (20% - 8%)

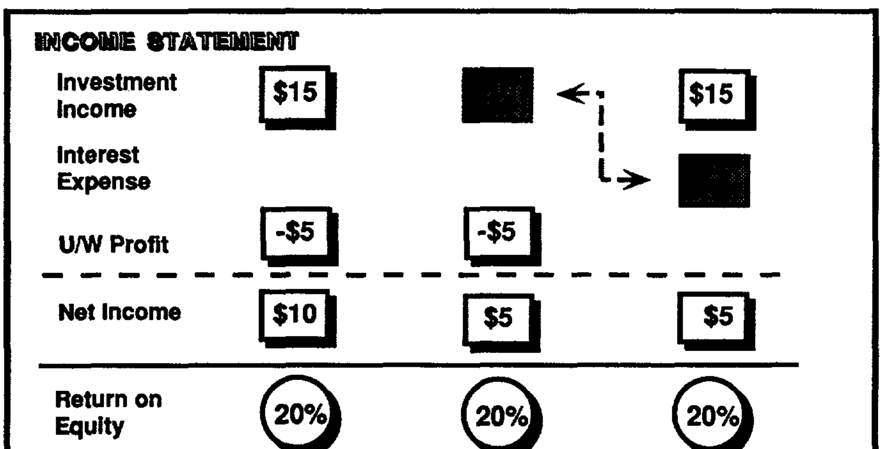
Exhibit 2

Separation of Investment and Insurance Operations

Required Return on Equity	20%	Pretax
Asset Yield	10%	Risky
Riskless Yield Rate	8%	
Loss	$105	Paid One Year Later



Notice that $125 cancels on consolidation.



Equity is assigned so that above ROE's have equal risk.

Exhibit 3, Page 1

Typical Product Line
Total Profit Concept

Target Calculation Summary

Generic Inputs

Riskless Yield	**8.00%**	**Equity Weights by Reserve Category**	
		UEPR	**1.30**
Base Risk Adjustment	**5.00%**	IBNR	**1.10**
		Case	**0.60**

Line Specific Inputs

	% of Premium	Duration in Years	Risk Adjust-ment	Risk Adjusted Yield	Present Value Amount	Benefit From Present Value
Premium	100.00	0.45	0.00%	8.00%	96.58	-3.42
Underwriting Costs						
Loss & LAE	67.88	3.45	5.06%	2.94%	61.42	6.46
Commissions	18.30	0.48	0.00%	8.00%	17.63	0.67
Internal Expense	15.62	0.37	0.00%	8.00%	15.18	0.44
TL&F	2.40	0.75	0.00%	8.00%	2.27	0.13
Dividends	0.10	1.88	0.00%	8.00%	0.09	0.01
Total	**104.30**				96.58	7.72
Underwriting Profit	-4.30				0.00	-4.30

Typical Product Line
Total Profit Concept

Breakeven Calculation Summary

	% of Premium	Duration in Years	Risk Adjust-ment	Risk Adjusted Yield	Present Value Amount	Benefit From Present Value
Premium	100.00	0.45	0.00%	8.00%	96.58	-3.42
Underwriting Costs						
Loss & LAE	75.23	2.99	0.00%	8.00%	59.77	15.45
Commissions	18.30	0.48	0.00%	8.00%	17.63	0.67
Internal Expense	17.32	0.37	0.00%	8.00%	16.83	0.49
TL&F	2.40	0.75	0.00%	8.00%	2.27	0.13
Dividends	0.10	1.88	0.00%	8.00%	0.09	0.01
Total	**113.34**				96.58	16.76
Underwriting Profit	-13.34				0.00	-13.34

Exhibit 4

PROFIT CENTER REPORTING
INCOME STATEMENT
(IN PENNIES)

LINE: ACTUARIAL PRODUCT LIABILITY

YEAR-TO-DATE
* DECEMBER 1990 *

		ACTUAL		PLAN		PRIOR YEAR	
		$ AMOUNT	% GROWTH	$ AMOUNT	% GROWTH	$ AMOUNT	% GROWTH
	PREMIUMS						
1	GROSS PREMIUM WRITTEN	380,210	5.2	361,026	(0.1)	361,381	16.1
2	NET PREMIUM WRITTEN	380,072	5.2	361,074	0.0	361,115	15.8
3	NET PREMIUM EARNED	368,893	5.8	353,070	1.3	348,561	14.6
		$ AMOUNT	% PREMIUM	$ AMOUNT	% PREMIUM	$ AMOUNT	% PREMIUM
	EXTERNAL EXPENSES						
4	COMMISSIONS	30,481	8.3	27,882	7.9	29,962	8.6
5	TAXES, LICENSES AND FEES	14,317	3.9	12,356	3.5	14,619	4.2
6	DIVIDENDS	23,294	6.3	19,772	5.6	21,316	6.1
7	INVOL BUSINESS CHARGE	13,206	3.6	12,535	3.6	13,564	3.9
8	TOT AY EXTERNAL EXPENSES	81,297	22.0	72,546	20.5	79,461	22.8
	CLAIMS & RELATED EXPENSES						
9	AY NON-CAT LOSSES	276,720	75.0	269,282	76.3	257,276	73.8
10	AY NON-CAT LOSS EXPENSES	44,149	12.0	39,544	11.2	40,416	11.6
11	CATASTROPHE LOSS CHARGE		0.0		0.0		0.0
12	TOT AY CLAIMS & RELATED EXP	320,869	87.0	38,826	87.5	297,691	85.4
	INTERNAL EXPENSES						
13	PROFIT CENTER EXPENSES	39,287	10.6	37,316	10.5	35,148	10.0
14	CORPORATE EXPENSES	7,701	2.1	8,047	2.3	8,805	2.5
15	TOTAL INTERNAL EXPENSES	46,988	12.7	45,363	12.8	43,953	12.6
16	**NET AY UNDER RESULTS**	(80,262)	(21.8)	(73,664)	(20.9)	(72,544)	(20.8)
17	TARGET AY UNDER RESULTS	(47,946)	(13.0)	(45,899)	(13.0)	(31,345)	(9.0)
18	BREAKEVEN AY UNDER RESULT	(84,828)	(23.0)	(81,206)	(23.0)	(62,691)	(18.0)
19	**RETURN ON EQUITY**		10.1		10.9		3.6

INVESTMENT INCOME IN RATEMAKING IN MASSACHUSETTS (SEMINAR ON PROFITABILITY, 4/91)

Howard Mahler

The issue of profitability of the major lines of Automobile and Workers' Compensation insurance in Massachusetts has been handled on an ex-ante formula basis since 1975. Beginning with Commissioner James M. Stone's Automobile Bodily Injury/Liability Decision for 1976 state set rates, explicit account has been taken of investment income. Although the computational techniques have changed over the years, the common thread has been to attempt to allow insurers a fair return on their equity.

The Myers-Cohn Model

The Myers-Cohn net present value model was developed for the Massachusetts Rating Bureaus by Stewart Myers and Richard Cohn.[1] It was intended as an improvement of the Fairley model which was used previously.[2] The basic concepts underlying the Fairley model, the model shown in my Proceedings paper "An Introduction to Underwriting Profit Models"[3] and the Myers-Cohn model are all similar. Given similar inputs all three models give similar (but not identical) results. The Myers-Cohn model was first presented in the Fall of 1981 at the 1982 automobile rate hearings. Then Commissioner Sabbagh used a modified version

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[1]The model was implemented for use in Massachusetts by Richard Derrig of the Rating Bureaus.

[2]The original Fairley Model, an improvement by Hill and Modigliani, and the Myers-Cohn Model, are all presented in Fair Rate of Return in Property-Liability Insurance, Kluwer-Nijhoff, 1986.

[3]PCAS LXXII, 1985. The model presented in the spring of 1981. It is described as "Model A" in Part III of the 1984 NAIC Study of Investment Income.

of this model to fix and establish the 1982 automobile rates. The Massachusetts Rating Bureaus used the Myers-Cohn model to derive its proposed Workers' Compensation underwriting profit provision as well. It is currently used, with some technical refinements, to set profit provision for both Automobile and Workers' Compensation insurance in Massachusetts.

The basic premise underlying the Myers-Cohn model can be stated this way: a fair premium must be equal to the expected losses and expenses, discounted to present value at a risk-adjusted rate, plus the present value of the Federal income taxes on underwriting and investment income, discounted at a risk-free rate. Premiums calculated this way should preserve the equity invested in the company and give the investor a fair return for the risk of underwriting by the company.

Simple Example, Profit Provision

In order to illustrate the use of the Myers-Cohn model, I will first present a simplified example. After that I will show what was done in the most recent Massachusetts Workers' Compensation rate filing.

It is neither the purpose nor intention of this talk to defend or justify what was done. For purposes of this talk you should view all inputs chosen and calculated profit provisions as solely for illustrative purposes. As with all profit models, the profit provision calculated using the Myers-Cohn model is very sensitive to the inputs chosen and assumptions made. Later in the talk, I will illustrate this sensitivity.

For this simplified example, I will make the following assumptions: All premiums are collected in quarter 1. All losses are paid in quarter 5. Variable expenses are 20% of premiums, and are paid in quarter 2. The ratio of fixed expenses to losses is 5%. Fixed expenses are paid in quarter 2. Loss adjustment expenses are 10% of losses, and are paid when losses are in quarter 5. There is no discounting of reserves (for tax purposes) and no taxing of the unearned premium reserve. There are no dividend payments.

The risk free rate is assumed to be 9%. (Presumably this was determined from rates of return available on duration matched Treasury Securities.) This is combined with an assumed Beta of Underwriting of -.2 and a Market Risk Premium of 10%, to get a risk adjusted rate of 7%. 7% = 9% - .2 x 10%. While this is based on the Capital Asset Pricing Model, some other means could be used to get the risk adjusted rate. The important concept is that discounting "risky" loss and expense flows at the smaller risk adjusted rate is intended to compensate insurers for the risk of underwriting insurance.

A 2 to 1 initial premium to surplus ratio is chosen. The surplus allocated to this policy is assumed to decline in proportion to the losses and expenses paid.

Using the Myers-Cohn profit model the calculated underwriting profit provision is -4.7% as shown in Exhibit 1. However, the purpose of this example is to illustrate and help to understand the method of calculation, rather than concentrate on the answer itself. Exhibits 2, 3 and 4 show in detail how the cashflows are constructed and how the Kappa values are determined. The Kappa values are "timing parameters." They are calculated by discounting the various cashflows at either the risk free or risk adjusted rate. Exhibit 2 shows the cashflows for the initial set of weights.[4] However, as the profit provision varies so does the relative weight given to variable expenses, so that the profit model is solved via iteration. Exhibit 4 shows the cashflows for the final weights.

Let's go through these exhibits in some detail. The top portion of Exhibit 1 shows the inputs and assumptions I have chosen for this example. Next are shown the various kappa values, which are defined in Exhibit 5.[5]

The calculation of the kappa values is shown in Exhibit 3, for the initial weights. κ_1 is the risk adjusted discounted loss and expense factor. We take the loss and expense flows from Exhibit 2 and discount them at the risk adjusted rate of 7%. (We divide the result by the sum of losses and expenses, which has been selected as 1000.)

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[4]The cashflows are constructed for a single policy (or set of policies with the same effective date), with a policy effective period of Quarters 1, 2, 3, and 4. Thus the policy effective date (time = 0) is at the end of Quarter 0, and the beginning of Quarter 1.

[5]The Myers-Cohn paper had only four kappas. One additional kappa was introduced in implementation to allow for the difference in timing between the payment of losses and expenses, and the timing of the tax consequences of incurring losses and expenses. $\kappa_1 \neq \kappa_5$. κ_6 was introduced in order to take into account the "revenue offset" feature of the Tax Reform Act of 1986.

κ_2 is the result of discounting the premium flow at the 9% risk free rate.

κ_3 is the result of discounting the investment balance for taxes at the risk free rate. The investment balance for taxes shown on Exhibit 2 is the sum of the surplus plus the premium dollars collected that have yet to be paid out as losses plus expenses.

κ_4 is the discounted contribution of premiums to the underwriting profit tax. κ_5 is similar but for losses and expenses, and thus discounted at a risk adjusted rate. Here it's assumed these take place evenly in the four policy quarters.

κ_6 is the discount factor for the taxing of the change in unearned premiam reserve.

On the bottom portion of Exhibit 1 is shown how the different factors are put together into a formula to calculate the ratio of premiums to losses and expenses and in turn the underwriting profit provision. Those terms involving losses and expenses are in numerator. The terms involving taxes of course include the tax rates τ_1 = underwriting tax rates or τ_2 = investment income tax rate.

The term $\tau_2 r\kappa_3$ is the tax rate τ_2 times the investment income of $r\kappa_3$, which is the quarterly rate of return times the (discounted) investment balance.

Once the ratio of P/(L+E) is calculated as .95541 the profit provision is 1-(1/.95541) = -4.7%. This can be thought of as a target combined ratio of 104.7% for this fictional example.

Filing for 1/1/91 Rates

Exhibits 5 through 8 are extracts from the filing for 1/1/91 Massachusetts Workers' Compensation rates. It should be noted that these are only the four summary pages out of a total of 168 pages in the profit section of that filing.

Exhibit 5 shows the definition of the variables and the equations for the Myers-Cohn model.

Exhibit 6 summarizes the inputs and the result. Unfortunately, the various cashflows which are shown in the rate filing, are too lengthy to be shown here. The Myers-Cohn model with the selected inputs produces a profit provision of -6.5%. To this was added an adjustment of 1.2% in order to cover investment expenses. (These expenses could be considered either in the setting of the profit provision or elsewhere in the rate filing.)

The footnotes on Exhibit 6 also mention two technical refinements introduced into the model. The risk adjustment decreases linearly to zero after quarter 5, as does the surplus/premium ratio. The model itself is flexible enough to accept any vector of risk adjusted rates by quarter as well as any form of surplus flow.

Exhibit 7 shows the kappa values and the computation of the -6.5% model profit provision. Again, let me state that for purposes of this talk, this -6.5% is just an illustrative number which may or may not be appropriate for any real world application.

Exhibit 8 calculates that the proposed -5.3% profit provision (including the adjustment for investment expenses) is expected to produce a post-dividend combined ratio to premiums (net of premium discount) of 110%.

Sensitivity Analysis

Exhibit 9 shows the sensitivity of the Myers-Cohn model to the choice of different inputs.

The risk free rate of return can vary by several percent from one year to the next. Generally, we have used an average of the last year's worth of rates available on a duration matched portfolio of treasury securities to estimate the risk free rate. For long-tailed lines like Workers Comp., a 1% change in interest rate produces more than a 1% change in profit provision.

If one assumed that underwriting was risk free (beta of underwriting equal to zero), there would be a more negative profit provision. The difference between this profit provision and the calculated profit provision represents the reward for taking the risk of writing insurance.

The investment income tax rate and premium to surplus ratio are other important and sometimes controversial inputs.

The tax reform act of 1986 introduced the discounting of loss reserves for tax purposes and the taxing of the unearned premium reserve. As expected, since each of these changes was intended to produce more taxes for the federal government, they each lead to a less negative underwriting profit provision. Insurers need more money to pay these taxes, all other things being equal.

Finally, the timing of the loss payments is an extremely important input. Changing this timing by one quarter of a year changes the profit provision by almost 1%. By the way, for Workers' Compensation we estimate that the average loss payment occurs approximately four years from policy inception.

Future Work

The Myers-Cohn model has been used in Massachusetts for approximately the last decade. During that time a number of refinements have been made for the purposes of various applications of the model. I've mentioned a few today.

Among the things the Workers' Compensation Rating Bureau has been investigating is what expected rate of return on equity is implied by the use of a profit provision calculated via the Myers-Cohn model. We have concluded that there is no unique rate of return on equity associated with any particular Myers-Cohn calculation. However, we are working through the additional assumptions that have to be made in order to assign a range of rates of return.

Conclusion

In Massachusetts the Myers-Cohn model has been used to set many profit provisions over the last decade. As with any profit model, in any real world application, one must carefully examine the underlying assumptions and inputs to make sure that everything is consistent. It has proven very easy for two people to get extremely different profit provisions using the same model.[6] The last decade has demonstrated the impossibility of coming up with either a universally accepted profit model or profit provision. However, the possibility of differing answers no more makes profit models useless, than would the inability to agree on exactly how to predict future loss levels make trending and loss development techniques useless. Profit models provide a framework for a rational discussion and allow the testing of the affect of changes to the tax law, investment policy, claims payment patterns, economic conditions, etc.

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[6]Even when using the same profit model for Workers' Compensation Insurance, disagreements of 10% or more in proposed profit provisions are not unheard of.

Myers-Cohn Profit Model

Example of Calculation of Underwriting Profit Provision

Inputs

Risk Free Rate = 9%
Beta of Underwriting = -.20
Market Risk Premium = 10%
Risk Adjusted Rate = 9% - .20 x 10% = 7%
Premium to Surplus ratio = 2
Federal Income Tax Rate on Underwriting = 34%.
Federal Income Tax Rate on Investment = 25%.
Expenses (other than loss adjustment expense) are all paid in quarter 2.
Variable Expenses are 20% of Premium.
Fixed Expenses are 5% of Losses.
Loss Adjustment Expense is 10% of Losses.
Premiums are all collected in quarter 1.
Losses and loss adjustment expense are all paid in quarter 5.
There are no Dividends paid.
There is no discounting of reserves (for tax purposes).
There is no taxing of the unearned premium reserve; alpha = 0.

Kappas	Initial Weights	Final Weights
κ_1 =	.938033	.937621
κ_2 =	.989286	.989286
κ_3 =	4.893530	4.929088
κ_4 =	.947839	.947839
κ_5 =	.958762	.958765
κ_6 =	.978686	.978686

Profit Provision

$$\frac{P}{L+E} = \frac{\kappa_1 - \tau_1\kappa_5}{\kappa_2 - \tau_2 r\kappa_3 - \tau_1\kappa_4 - \tau_1\alpha\kappa_6}$$

$$= \frac{.937621 - .34(.958765)}{.989286-(.25 \times .021778 \times 4.929088)-(.34 \times .947839)-(.34 \times 0 \times .978686)}$$

$$= .95541$$

$$\mu = 1 - (P/(L+E))^{-1} = -4.7\%$$

Example Cashflows
(Initial Weights)

Quarter	Premiums	Losses	Expenses*	Cumulative Difference	Surplus	Investment Balance**
0	0	0	0	0	250.00	250.00
1	1000.00	0	0	1000.00	500.00	1500.00
2	0	0	234.78	765.22	382.61	1147.83
3	0	0	0	765.22	382.61	1147.83
4	0	0	0	765.22	382.61	1147.83
5	0	695.65	69.57	0	0	0
	1000.00	695.65	304.35			

The policy inception date is at the end of quarter zero and the beginning of quarter one.

*Expenses are the sum of 200 (20% of premium) representing variable expense in quarter 2, 34.78 (5% of losses) representing fixed expense in quarter 2, and 69.57 (10% of losses) representing l.a.e. in quarter 5. Note that for the initial weights, losses plus expenses = 1000 = premiums.

** Investment Balance is the sum of the surplus and the cumulative difference of premiums and losses.

Example Calculation of Kappas (Initial Weights)

κ_1 = risk adjusted discounted losses and expenses factor

$.76522 \times (1.07)^{4.5+4}$

$+ .23478 \times (1.07)^{-1.5+4}$

$= .9380$

Note: Losses and loss adjustment expenses discounted to the middle of the fifth quarter. Expenses discounted to the middle of the second quarter.

κ_2 = risk free discounted premiums factor

= Discounted Value of Premium Flow

= .9893

Note: Discounting to the middle of the first quarter

$.9893 = (1.09)^{-.5+4}$

κ_3 = risk free discounted investment balance tax factor

= Discounted Investment Balance for Taxes

= (250x.9893)+(1500x.9682)+(1147.83x.9476)+(1147.83x.9274)+(1147.83x.9076)

= 4.8935

κ_4 = risk free underwriting profit tax factor (contribution of premiums)

= (.25x.9787)+(.25x.9578)+(.25x.9374)+(.25x.9174)

= .9478

Note: Discounting to the end of the first, second, third, and fourth quarters.

κ_5 = risk adjusted discounted underwriting profit tax factor (contribution of losses and expenses)

= (.25x.9832)+(.25x.9667)+(.25x.9505)+(.25x.9346)

= .9588

Note: Discounting to the end of the first, second, third, and fourth quarters.

κ_6 = risk free discounted unearned premium tax factor

= .9787

Note: Discounting to the end of the first quarter

Exhibit 4

Example Cashflows
(Final Weights)

Quarter	Premiums*	Losses	Expenses**	Cumulative Difference	Surplus	Investment Balance***
0	0	0	0	0	250.00	250.00
1	1000.00	0	0	1000.00	500.00	1500.00
2	0	0	226.25	773.75	386.87	1160.62
3	0	0	0	773.75	386.87	1160.62
4	0	0	0	773.75	386.87	1160.62
5	0	703.41	70.34	0	0	0
	1000.00	703.41	296.59			

The policy inception date is at the end of quarter zero and the beginning of quarter one.

* Premiums shown are prior to the profit loading. The premium loaded for profit is 955.41.

** Expenses are the sum of 191.08 (20% of premiums loaded for profit of 955.41) representing variable expense in quarter 2, 35.17 (5% of losses) representing fixed expense in quarter 2, and 70.34 (10% of losses) representing l.a.e. in quarter 5. Note that losses plus expenses = 1000.

*** Investment Balance is the sum of the surplus and the cumulative difference of premiums and losses.

Massachusetts Workers' Compensation

WCRB Formulation of the Myers-Cohn: 1987 Tax Law
Cost of Capital Underwriting Profit Provision Model[1]

Let

Flows
- P = Premium
- L = Losses
- E = Expenses
- IVB = Investment Balance
- IVBT = Investment Balance for Tax
- UWP = Underwriting Profit

Capital Market Rates
- r = Risk Free Rate
- r_L = Risk-Adjusted Rate (Adjusted for Risk of Underwriting by Line)
- τ_1 = Federal Underwriting Income Tax Rate
- τ_2 = Federal Investment Income Tax Rate
- μ = Underwriting Profit Margin
- α = Unearned Premium Reserve Factor for Taxes

Then, given the basic valuation equations of The Myers-Cohn model,

(1) Present Value of Premium = Present Value of Losses and Expenses plus Present Value of Federal Tax Liabilities on Underwriting Profits and Investment Income on the Investment Balance.

or

(1)' $PV(P) = PV(L + E) + PV\ (UWP\ \tau_1) + PV\ (IVBT\ r\tau_2)$

Where,

the investment balance flow, IVB, is defined as the funds available for investment from the policy cash flow, cumulative premium minus cumulative losses, plus those funds available from other supporting assets. IVBT is IVB advanced one quarter to the time period when the income is earned and the tax liability is incurred.

Then, if premiums and investment income are valued at the risk free rate r, losses and expenses valued at a risk adjusted rate; underwriting and investment income taxed at rates τ_1 and τ_2 ; and underwriting profits taxed using after-dividend premiums and discounted loss reserves:

(2) $$PV_r\ (P) = PV_{r_L}(L+E) + PV_r(P\ \tau_1\ UWP/(P-(L+E))) - PV_{r_L}((L+E)\tau_1\ UWP/(P-(L+E))) + PV_r\ (r\tau_2\ (IVBT))$$

or

(2)' $$\frac{P}{L+E} = \frac{\kappa_1 - \tau_1\kappa_5}{\kappa_2 - \tau_2\ r\kappa_3 - \tau_1\ \kappa_4 - \alpha\ \tau_1\ \kappa_6}$$

and $\mu = 1-(P/(L + E))^{-1}$

Where κ_1 = risk adjusted discounted losses and expenses factor
- κ_2 = risk free discounted premiums factor excluding policyholder dividends
- κ_3 = risk free discounted investment balance tax factor
- κ_4 = risk free discounted underwriting profit tax factor
- κ_5 = risk adjusted discounted underwriting profit tax factor
- κ_6 = risk-free discounted unearned premium tax factor

[1] Chapter 3 of J.D. Cummins and S.E. Harrington, eds., Fair Rate of Return on Property-Liability Insurance, Hingham, Mass., Kluwer-Nijhoff, 1986.

Massachusetts Workers' Compensation

Filing for 1/1/91 Rates

Model Profit Allowance	-6.5%
Adjustment for Investment Expenses	1.2%
Underwriting Profit Allowance	-5.3%

Parameters

Capital Market Rates	
Risk-Free Rate	8.39%
Risk-Adjusted Rate	6.50%*
(Beta = -.21, Market Risk Premium 9%)	
Federal Tax Rates (Post Tax Reform Act of 1986)	
Underwriting	34%
Investment	28.2%
Premium/Surplus Ratio	2 to 1**
Policyholder Dividends (as a percent of Net Premium)	4.19%
Policyholder Dividends (as a percent of Standard Premium)	3.75%

* Risk-Adjusted rate for quarters -3 through 5. Risk-adjusted rate increases linearly to the risk free rate from quarter 5 to the end of the loss and expense flow. Equivalently, the absolute value of beta decreases linearly to zero.

** Consistent with the change in the risk-adjusted rate, the surplus/premium ratio decreases linearly to zero from quarter 5 to the end of the loss and expense flow.

Massachusetts Workers' Compensation

Filing for 1/1/91 Rates

Calculation of Underwriting Profit Provisions
Using Myers-Cohn Cost of Capital Model

$$\frac{P}{L+E} = \frac{\kappa_1 - \tau_1 \kappa_5}{\kappa_2 - \tau_2 r \kappa_3 - \tau_1 \kappa_4 - \tau_1 \alpha \kappa_6}$$

$$\mu = 1 - (P/(L+E))^{-1}$$

$r = .020346$ $r_L = .015868$ $\tau_1 = .34$ $\tau_2 = .282$ $\beta = -.21$ $\alpha = .010511$

Discounting Factors

$\kappa_1 = .808618$
$\kappa_2 = .919674$
$\kappa_3 = 13.376$
$\kappa_4 = .917902$
$\kappa_5 = .921415$
$\kappa_6 = .943307$

$$\frac{P}{L+E} = \frac{.808618 - .34(.921415)}{.919674 - .282(.020346)(13.376) - .34(.917902) - .34(.010511)(.943307)}$$

$= .939080$

$\mu = 1-(.939080)^{-1} = -.0649$

Model Provision = -6.5%

Massachusetts Workers' Compensation

Filing for 1/1/91 Rates

1.	Expected Manual Underwriting Ratio	105.30%
2.	Expected Premium Discount	10.50%
3.	Expected Discount as Proportion of L+E	9.86%
4.	Expected Net Underwriting Ratio (1) x (1-(3))/(1-(2))	106.05%
5.	Expected Net Dividend Ratio	4.19%
6.	Expected Target Underwriting Ratio (post dividend) (4) + (5)	110.24%

Exhibit 9

Sensitivity Analysis
Myers - Cohn Profit Model

Base Case: Filing for 1/1/91 MA W.C. Rates

Risk Free Rate	Model Profit Provision	Difference
10.39%	-9.5%	-3.0%
8.39%	-6.5%	Base
6.39%	-3.1%	+3.4%
Beta of Underwriting		
-.11	-9.3%	-2.8%
-.21	-6.5%	Base
-.31	-3.7%	+2.8%
Investment Income Tax Rate		
26.2%	-7.6%	-1.1%
28.2%	-6.5%	Base
30.2%	-5.3%	+1.2%
Underwriting Income Tax Rate		
36%	-6.7%	-.2%
34%	-6.5%	Base
32%	-6.3%	+.2%
(Initial) Premium to Surplus Ratio		
3	-8.5%	-2.0%
2	-6.5%	Base
1	-.5%	+6.0%
Policyholder Dividends		
0	-11.0%	-4.5%
3.75%	-6.5%	Base
7.50%	-2.0%	+4.5%
Loss Reserves for Tax Purposes		
No Discounting	-9.7%	-3.2%
Discounting as per TRA '86	-6.5%	Base
Taxing of the Unearned Premium Reserve		
None	-7.2%	-.7%
As per TRA '86	-6.5%	Base
Timing of Loss Payments		
One Quarter Later	-7.4%	-.9%
As per rate filing	-6.5%	Base
One Quarter Earlier	-5.7%	+.8%

A GUIDE TO THE EVALUATION OF PROPERTY-LIABILITY REINSURERS UNDER THE NAIC INSURANCE REGULATORY INFORMATION SYSTEM

Reinsurance Association of America

INTRODUCTION

Companies writing reinsurance are involved in the highest risk sector of the property-liability business. Commercial lines and liability exposures, the most difficult lines on a primary basis, are the types of risks most often reinsured. Because of this, the financial standards established for reinsurers should be carefully monitored.

BACKGROUND

In April 1989 the Reinsurance Association of America (RAA) published the first edition of its guide to the evaluation of property-liability reinsurers under the NAIC Insurance Regulatory Information System (IRIS). The project was undertaken in response to several factors: (1) requests from insurance regulators for information which would expedite the early identification of financially troubled reinsurers; (2) peculiar results evidenced by reinsurers under financial evaluation programs such as IRIS; and (3) the desire to encourage the use by regulators of meaningful standards for analyzing reinsurers. The current edition updates the 1989 report and includes data on the reinsurance industry's performance during the period 1985 through 1989.

PROCEDURES

IRIS Ratios were calculated for each of the years 1985 through 1989 to determine the following statistical information on the reinsurance industry:

1. the weighted average ratios (data aggregated, and then ratios computed);
2. the mean ratios (ratios computed by company, aggregated, and then divided by the number of companies); and
3. an evaluation of each ratio at 10, 25, 50, 75, and 90th percentiles (the 50th percentile representing the median).

The second and third computations exclude the unusual ratio values of -99 and 999 which appear when "normal" results cannot be calculated. The NAIC, in preparing its IRIS report, also computes the industry-wide mean and median with these unusual values excluded, noting that this makes the results more realistic.

A five year history of ratios for the reinsurance industry on a weighted, mean and percentile basis precedes the discussion of each ratio. The results are also compiled in Exhibit I.

Exhibit II represents a summary of 1989 mean and median ratios for reinsurers and for the total insurance industry.

APPLICATION

While these ratios can be a helpful regulatory tool, their scope and applicability must be considered. Regulatory officials must consider the status of the reinsurance market as a whole when evaluating an individual company's performance and financial solvency. Also, the ratio results must be evaluated over a number of years, and some ratios are not valid for evaluating the financial performance of new market entrants. Finally, any special transactions or mix of business changes distorting this analysis must be considered.

Although the report contains comments on several concepts applicable to the ratios, the reader should be aware that not all conceivable issues can be addressed in this limited analysis.

Among other issues which the reader may want to consider are:

- the effect of the current trend toward consolidation in the industry;
- the effect of large volume transactions;
- the effect of federal income taxes.

RATIO 1

PREMIUM TO SURPLUS

WEIGHTED AVERAGE

	1985	1986	1987	1988	1989
RATIO	157.2	143.1	128.0	100.0	86.0

MEAN

	1985	1986	1987	1988	1989
RATIO	135.4	129.9	109.2	92.2	92.4

PERCENTILE

	1985	1986	1987	1988	1989
10TH PCTL	35.0	26.3	23.6	22.7	25.4
25TH PCTL	66.7	76.0	71.5	48.9	49.9
50TH PCTL	131.8	128.4	108.3	88.1	76.5
75TH PCTL	183.4	171.1	150.6	119.8	111.5
90TH PCTL	238.7	218.2	174.8	157.2	150.1

Source: A.M. Best Company - By Permission

The premium to surplus ratio should generally be lower for reinsurers than for primary companies. The difference between the values for the total industry and reinsurers reflects the higher risk potential assumed by reinsurers; however, a reinsurer assuming mostly proportional (pro-rata) business could have results similar to those of its ceding insurers.

It is also possible for a reinsurer to be overleveraged without having an unusual ratio value. Reinsurance is inherently riskier in part because of the protracted loss development. As a result, for non-proportional (excess of loss) reinsurance, the magnitude of risk per dollar of premium differs significantly from that at the primary level. In addition, certain lines of non-proportional business will develop more slowly than others.

Changes to the Statutory Annual Statement implemented in 1988 provide new information which is helpful in the analysis of an insurer's premium to surplus ratio. Reinsurers, and primary insurers assuming reinsurance, report premiums and losses for proportional business on lines 1-29 of the Underwriting and Investment Exhibit. Non-proportional business is reported on lines 30A, 30B, and 30C for property, casualty, and other reinsurance respectively. The degree of risk inherent in the different lines of business should be considered when evaluating a particular company.

Over time, the premium to surplus ratios of both the total insurance industry and the reinsurance industry will vary with market conditions. These conditions do not necessarily have the same effect on reinsurers as on the total industry.

RATIO 2

CHANGE IN WRITINGS

WEIGHTED AVERAGE

	1985	1986	1987	1988	1989
RATIO	37.8	48.3	2.0	-9.9	-2.1

MEAN

	1985	1986	1987	1988	1989
RATIO	45.9	68.8	19.3	12.9	12.2

PERCENTILE

	1985	1986	1987	1988	1989
10TH PCTL	-25.8	-13.4	-25.2	-29.1	-22.0
25TH PCTL	5.2	0.1	-13.7	-20.3	-10.9
50TH PCTL	34.6	31.1	3.3	-3.4	1.1
75TH PCTL	67.8	70.4	18.9	11.4	21.2
90TH PCTL	109.2	174.9	62.9	58.6	46.3

Source: A.M. Best Company - By Permission

Changes in writings often reflect market conditions. Characteristically, reinsurance premiums increase more rapidly than primary premiums in hard markets and decrease more rapidly in soft markets. When using this ratio, it is important to distinguish between the portion of the change attributable to changing rate levels and the portion attributable to changing risk exposure. For example, the unprecedented increase in writings by reinsurers in 1985-1986 reflected market conditions in that period and predominantly represented rate increases rather than increases in exposure.

For an individual insurance or reinsurance company, rapid increases in premium relative to the appropriate average may be an indication of cash flow or other problems. For this reason, special attention should be given to organizations varying markedly from median test results in either the industry or the reinsurance segment as is applicable.

RATIO 3

SURPLUS AID TO SURPLUS

WEIGHTED AVERAGE

	1985	1986	1987	1988	1989
RATIO	2.3	1.2	0.6	0.5	0.5

MEAN

	1985	1986	1987	1988	1989
RATIO	2.0	1.0	0.7	0.6	0.6

PERCENTILE

	1985	1986	1987	1988	1989
10TH PCTL	0.0	0.0	0.0	0.0	0.0
25TH PCTL	0.0	0.0	0.0	0.0	0.0
50TH PCTL	0.1	0.0	0.0	0.0	0.0
75TH PCTL	1.8	0.6	0.4	0.5	0.5
90TH PCTL	8.4	3.0	1.4	1.3	1.4

Source: A.M. Best Company - By Permission

Surplus aid has not generally been a factor in the reinsurance industry.

RATIO 4

TWO-YEAR OVERALL OPERATING RATIO

WEIGHTED AVERAGE	1985	1986	1987	1988	1989
RATIO	105.1	94.3	87.8	84.4	83.0

MEAN	1985	1986	1987	1988	1989
RATIO	99.7	88.4	87.3	87.5	86.7

PERCENTILE	1985	1986	1987	1988	1989
10TH PCTL	78.0	32.3	70.2	71.7	71.8
25TH PCTL	94.4	84.9	80.8	79.5	82.0
50TH PCTL	101.1	93.0	87.1	85.1	86.9
75TH PCTL	112.2	99.5	93.3	90.6	92.5
90TH PCTL	124.6	119.9	114.8	96.8	99.5

Source: A.M. Best Company - By Permission

Over the long term, this ratio should be under 100 percent. Two years may not be sufficient to determine the long-term profitability of either an individual reinsurer or the reinsurance segment. Additionally, the impact of a natural, man-made or tort catastrophe could distort the results for the reinsurance industry. In the case of a particular reinsurer, volatile operating ratios greater than 100 percent should be cause for increased scrutiny.

This ratio is comprised of two components, investment income and underwriting results. Due to the magnitude of the investment income component, particularly for reinsurers, the underwriting component may be overshadowed. Operating ratios may be improving while combined ratios deteriorate. Therefore, the two components should be analyzed separately.

It should be noted that this ratio does not include the effect of the federal income tax. Since enactment of the Tax Reform Act of 1986, federal income tax has become a material item affecting bottom line profitability and financial condition.

RATIO 5

INVESTMENT YIELD

WEIGHTED AVERAGE

	1985	1986	1987	1988	1989
RATIO	8.4	7.8	7.7	7.6	7.8

MEAN

	1985	1986	1987	1988	1989
RATIO	8.8	7.2	7.5	7.7	8.1

PERCENTILE

	1985	1986	1987	1988	1989
10TH PCTL	5.8	3.1	5.3	5.9	6.2
25TH PCTL	7.6	6.0	6.1	6.5	7.1
50TH PCTL	8.8	7.5	7.4	7.4	8.0
75TH PCTL	9.9	8.7	8.2	8.4	8.7
90TH PCTL	11.6	9.6	9.6	10.2	9.5

Source: A.M. Best Company-By Permission

If the investment yield of a reinsurer is unusually high in comparison with the reinsurance segment, the nature and quality of its investments should be questioned. Since a reinsurer is already bearing a significant level of underwriting risk it would generally not be appropriate also to become involved in speculative investments. However, a reinsurer engaged in long-tail lines of business could acquire investments of a somewhat longer than average term and still match liabilities as they become due for payment. Longer-term investments often have a higher yield. The new Schedule D summary in the 1990 annual statement reflects the NAIC's heightened concern with asset quality.

Capital gains and losses are not included in the calculation of this ratio, though these items may be a material part of the investment strategy of some companies. The tax strategy employed by a company may also affect the investment yield.

RATIO 6

CHANGE IN SURPLUS

WEIGHTED AVERAGE

	1985	1986	1987	1988	1989
RATIO	30.4	57.2	13.0	14.0	12.7

MEAN

	1985	1986	1987	1988	1989
RATIO	29.5	53.0	21.9	16.0	15.0

PERCENTILE

	1985	1986	1987	1988	1989
10TH PCTL	-13.9	0.3	-2.0	-2.2	-6.7
25TH PCTL	-0.5	12.2	5.1	5.2	1.7
50TH PCTL	14.7	28.2	10.2	12.5	8.5
75TH PCTL	54.6	68.9	19.5	20.0	15.7
90TH PCTL	93.0	109.1	46.7	46.5	52.2

Source: A.M. Best Company - By Permission

The change in surplus of a reinsurer can result from operations or external factors such as capital contributions or dividends. Surplus changes are detailed on page 4 of the annual statement. The external source of most additional surplus the reinsurance segment received in the mid-1980s came as contributions from parents or as proceeds from the sale of stock.

Possible use of surplus relief reinsurance to increase surplus can be checked by reviewing the result of Ratio 3 (Surplus Aid to Surplus).

RATIO 7

LIABILITIES TO LIQUID ASSETS

WEIGHTED AVERAGE

	1985	1986	1987	1988	1989
RATIO	92.9	87.0	86.6	85.0	83.6

MEAN

	1985	1986	1987	1988	1989
RATIO	76.0	73.5	75.4	70.0	70.5

PERCENTILE

	1985	1986	1987	1988	1989
10TH PCTL	38.0	13.8	31.2	35.1	40.3
25TH PCTL	53.4	51.7	60.4	55.0	56.1
50TH PCTL	77.5	76.8	77.3	74.9	73.7
75TH PCTL	94.9	88.1	89.8	83.7	85.4
90TH PCTL	107.4	103.4	99.9	92.3	95.7

Source: A.M. Best Company - By Permission

There is a general perception that reinsurers are less likely to require liquid assets for immediate payment than primary carriers due to their long-tail liabilities. However, reinsurers need to be highly liquid in order to cover catastrophe losses and large loss payments.

Relative to the total industry, a greater portion of reinsurance loss reserves will be reserves for incurred but not reported (IBNR) losses due to the slow development of reinsurance losses and their long-term payout pattern. As a result, reinsurers may have somewhat higher values for Ratio 7 than the entire insurance industry has.

The technical comments to "Insurance Regulatory Information System Ratio Results 1989" ("IRIS Ratio Results 1989") for Ratio 7 note that "Companies maintaining large deposits with companies that they reinsure tend to have higher ratio results." This occurs because funds held by or deposited with ceding companies are not considered in the formula as liquid assets. However, contractual arrangements involving funds held by ceding companies generally are permitted under current law to give reinsurers the right of offset against outstanding losses and other liabilities. Furthermore, since the amounts due a ceding company are considered as liabilities, it would arguably be consistent to include the corresponding assets. Funds held are often part of the economic reason for entering into reinsurance arrangements and often are a material balance sheet item for reinsurers.

RATIO 8

AGENTS' BALANCES TO SURPLUS

WEIGHTED AVERAGE

	1985	1986	1987	1988	1989
RATIO	23.2	18.2	17.4	12.9	12.1

MEAN

	1985	1986	1987	1988	1989
RATIO	22.4	15.7	15.1	10.8	11.9

PERCENTILE

	1985	1986	1987	1988	1989
10TH PCTL	0.0	0.0	0.0	0.0	0.0
25TH PCTL	1.7	0.7	3.2	0.3	1.0
50TH PCTL	16.0	10.6	7.9	8.7	6.3
75TH PCTL	33.0	23.2	20.1	16.8	15.7
90TH PCTL	53.3	39.1	35.7	24.8	29.5

Source: A.M. Best Company-By Permission

In reviewing the ratio of a reinsurer, the reason for a value markedly higher than the reinsurance segment should be determined. However, as indicated in the technical comments to "IRIS Ratio Results 1989," reinsurers' results for this ratio may exceed the results of primary companies. The agents' balances account, in the case of reinsurers, is made up principally of amounts due from reinsured companies. The quality of this asset is generally higher than agents' balances for a primary carrier.

While agents' balances may become a problem in the case of a primary insurer and not be available in the event of liquidation, under current law a reinsurer's balance due from ceding companies may be set off against losses as they arise. In fact, reinsurance contracts often provide for netting of losses and premiums due from the same company.

In addition, the extended time for payment of reinsurance premiums may make reinsurance balances larger than those of primary companies. Furthermore, when transactions involve alien insurers, premium due dates may be further extended.

RATIOS 9 AND 10

ONE-YEAR RESERVE DEVELOPMENT TO SURPLUS

WEIGHTED AVERAGE

	1985	1986	1987	1988	1989
RATIO	23.5	24.4	14.3	7.6	1.6

MEAN

	1985	1986	1987	1988	1989
RATIO	24.8	20.1	17.1	9.5	6.2

PERCENTILE

	1985	1986	1987	1988	1989
10TH PCTL	−1.4	−0.5	−1.2	−3.8	−14.0
25TH PCTL	0.3	0.0	0.0	−0.4	−4.7
50TH PCTL	7.9	11.3	5.4	3.6	0.4
75TH PCTL	26.4	34.8	16.1	9.9	6.8
90TH PCTL	79.1	55.7	36.7	20.4	15.0

Source: A.M. Best Company - By Permission

TWO-YEAR RESERVE DEVELOPMENT TO SURPLUS

WEIGHTED AVERAGE

	1985	1986	1987	1988	1989
RATIO	28.3	48.0	54.5	27.6	11.9

MEAN

	1985	1986	1987	1988	1989
RATIO	29.5	46.1	48.5	28.9	12.2

PERCENTILE

	1985	1986	1987	1988	1989
10TH PCTL	−0.0	−4.3	−1.6	−5.3	−14.1
25TH PCTL	2.7	2.7	5.2	0.4	−1.2
50TH PCTL	15.3	27.6	28.4	14.2	4.9
75TH PCTL	45.1	64.0	72.9	32.1	18.2
90TH PCTL	85.5	138.2	119.2	54.0	35.1

Source: A.M. Best Company - By Permission

History indicates that reinsurers' values on these ratios may be higher than those of the total industry even in a period of relative stability. Some of the reasons for this are the severity and unpredictability of reinsurance losses, time lags in loss reporting, and the leveraging effect of social and economic inflation.

When analyzing a reinsurer, attention should be given to the relationship of paid to incurred losses. The difference represents the change in reserves. For example, if paid loss ratios are increasing while incurred loss ratios remain constant, smaller reserve increases are being made despite increasing levels of payment.

Given the same distribution by line of business, the higher the ratio of paid losses to incurred losses for an accident year, at the same maturity level, the more unfavorable should be the interpretation of the tests' stated reserve adequacy. Conversely, the lower the ratio of paid losses to incurred losses for any accident year at the same "age", all things being equal, the more favorable should be the interpretation of the tests' stated reserve adequacy. The data to perform this analysis can be found in Schedule P. As a caveat, any special transactions or mix of business changes distorting this analysis must be considered. Furthermore, the Schedule P Summary and line 30B are likely to contain non-homogeneous data as well as changes in mix of business by year.

Ratios 9 and 10 determine how loss and loss adjustment expense reserves for prior years have developed. They do not reflect additional premiums generated by loss development, but merely relate to a determination of the adequacy or inadequacy of the reserve liabilities. Many reinsurance companies write substantial amounts of retro-rated business. For this business, as losses are reported or reported losses are developed, additional premiums may be earned, reducing the impact of the adverse development. Annual statement loss development schedules may not match these additional premiums to the accident years for which they are collected. Some reinsurers also have sliding scale commission adjustments that can further reduce the impact of any adverse development.

In the analysis of a reinsurer, the comparison with values for the reinsurance segment should be considered. The absence of an unusual value does not indicate that a problem does not exist.

RATIO 11

ESTIMATED CURRENT RESERVE DEFICIENCY TO SURPLUS

WEIGHTED AVERAGE

	1985	1986	1987	1988	1989
RATIO	49.4	74.2	25.7	-36.1	-32.9

MEAN

	1985	1986	1987	1988	1989
RATIO	28.5	36.3	13.5	-14.9	-22.3

PERCENTILE

	1985	1986	1987	1988	1989
10TH PCTL	-25.2	-7.7	-29.5	-63.5	-63.7
25TH PCTL	-3.2	0.0	-15.4	-47.2	-42.6
50TH PCTL	8.4	14.6	0.0	-18.1	-21.2
75TH PCTL	54.1	60.4	22.7	0.0	-1.5
90TH PCTL	131.4	124.3	78.4	7.9	12.7

Source: A.M. Best Company-By Permission

This ratio, as opposed to the other ratios which report historical data, attempts to estimate current reserve deficiencies or redundancies. It should be used with great care since the values obtained are not a meaningful indication of current reserve levels. The ratio presupposes that both past loss development (Ratios 9 and 10) and prior premium levels are indicative of the future. Typically, this ratio indicates reserves are adequate in a period when premuims are increasing and redundant when premiums are declining. Also, significant changes in mix of business may distort this ratio. The shortcomings of this ratio can be seen in the wide swing in results between 1987 and 1988.

RELATED ARTICLES

Individuals interested in the financial analysis of reinsurers also may find the following articles to be useful:

1. Bailey, Robert A., "Analyzing and Ranking Reinsurers," *Journal of Insurance Regulation*, June, 1988, p. 435.

2. Ludwig, Stephen J., and McAuley, Robert F., "A Non-Parametric Approach to Evaluating Reinsurers' Financial Strength," Casualty Actuarial Society Discussion Paper Program, 1987, p. 229.

STATISTICAL APPENDIX

The IRIS ratio computations were produced to indicate the results of the professional reinsurance industry for comparison with the total insurance industry.

In the previous edition the data base contained 139 companies considered reinsurers by A.M. Best Company. The data base for this edition contains 112 reinsurers after eliminating a number of companies which are either in runoff or inactive as identified by a Best classification of NA-4 Rating Procedure Inapplicable or a premium to policyholders surplus of less than 0.1.

"Weighted" results were produced by aggregating the data for all companies and computing each ratio.

"Mean" results were produced by aggregating the individual results of all companies and dividing by the number of companies.

"Percentile" results represent an evaluation of each test result at the 10, 25, 50, 75, and 90th percentiles.

EXHIBIT II

1989 MEAN AND MEDIAN RATIO RESULTS

Ratios	Mean		Median	
	2377 Companies	112 Reinsurers	2377 Companies	112 Reinsurers
1. Premium to Surplus	117.6	92.4	96.0	76.5
2. Change in Writings	16.4	12.2	2.0	1.1
3. Surplus Aid to Surplus	4.1	0.6	0.0	0.0
4. Two-Year Operating Ratio	74.4	86.7	86.0	86.9
5. Investment Yield	7.7	8.1	7.7	8.0
6. Change in Surplus	14.0	15.0	9.0	8.5
7. Liabilities to Liquid Assets	69.0	70.5	72.0	73.7
8. Agents' Balances to Surplus	16.7	11.9	6.0	6.3
9. One-Year Reserve Development	4.5	6.2	0.0	0.4
10. Two-Year Reserve Development	10.7	12.2	0.0	4.9
11. Estimated Current Reserve Deficiency	-2.6	-22.3	1.0	-21.2

Source: Data on 2377 Companies — NAIC Insurance Regulatory Information Systems Ratio Results 1989 - By Permission

Data on 112 Professional Reinsurers — A.M. Best Company - By Permission

STATEMENT OF ACTUARIAL OPINION – INSTRUCTIONS FOR 1991

NAIC
(with a letter and attachment
from R. Michael Lamb)

Statement of Actuarial Opinion
Instructions for 1991 Blank (Due March 1, 1992)

The National Association of Insurance Commissioners (NAIC) adopted a revision to the instructions for the 1991 Annual Statement Blank due March 1, 1992 regarding the scope and content of the Statement of Actuarial Opinion on casualty loss reserves.

The next seven pages is Instruction 12 as adopted. The ten pages following those are a letter and attachment from R. Michael Lamb, Chairman of the NAIC Casualty Actuarial (Technical) Task Force to the Chairman of the NAIC Blanks Task Force dated June 26, 1990. That material annotates the changes.

Due to the significance of the scope of these changes, we thought this material would be useful to you.

12. (1) STATEMENT OF ACTUARIAL OPINION

There is to be included or attached to Page 1 of the Annual Statement, the statement of a qualified actuary, entitled "Statement of Actuarial Opinion," setting forth his or her opinion relating to loss and loss adjustment expense reserves.

(2) DEFINITIONS

"Qualified actuary" is a person who is either:

(a) A member in good standing of the Casualty Actuarial Society, or

(b) A member in good standing of the American Academy of Actuaries who has been approved as qualified for signing casualty loss reserve opinions by the Casualty Practice Council of the American Academy of Actuaries, or

(c) A person who otherwise has competency in loss reserve evaluation as demonstrated to the satisfaction of the insurance regulatory official of the domiciliary state. In such case, at least 90 days prior to the filing of its annual statement, the insurer must request approval that the person be deemed qualified and that request must be approved or denied. The request must include the NAIC Biographical form and a list of all loss reserve opinions and/or certifications issued in the last 3 years by this person.

Notwithstanding the above, a domiciliary commissioner may, by bulletin or regulation, specify who may sign an opinion. Also, a domiciliary commissioner may require particular qualifications, including independence, for specific insurers.

"Insurer" means an insurer authorized to write property and/or casualty insurance under the laws of any state and includes but is not limited to fire and marine companies, general casualty companies, local mutual aid societies, statewide mutual assessment companies, mutual insurance companies other than farm mutual insurance companies and county mutual insurance companies, Lloyd's plans, reciprocal and interinsurance exchanges, captive insurance companies, risk retention groups, stipulated premium insurance companies, and non-profit legal services corporations.

"Annual Statement" means the annual financial statement required to be filed by insurers with the commissioner.

(3) CONTENT

The opinion shall be in the format of and contain the information required by this Section 12 of the Annual Statement Instructions: Property and Casualty.

(4) EXEMPTIONS

A certified copy of the approved exemption must be filed with the annual statement in all jurisdictions in which the company is authorized.

Automatic Exemption

(a) An insurer otherwise subject to the requirement that has less than $1,000,000 total direct plus assumed written premiums during a calendar year or that has less than a total of 1,000 policyholders and certificate holders at the end of a calendar year, in lieu of the certification required for the calendar year, may submit an affidavit under oath of an officer of the insurer that specifies that amount of direct plus assumed premiums written and the total number of policyholders and certificate holders.

(b) An insurer who intends to file for an exemption under this section must submit a letter of intent to its domiciliary commissioner no later than December 1 of the calendar year for which the exemption is to be claimed. The commissioner may deny the exemption prior to December 31 of the same year if he deems the exemption inappropriate.

Exemption for Insurers under Supervision or Conservatorship

Unless ordered by the domiciliary commissioner, an insurer that is under supervision or conservatorship pursuant to statutory provision is exempt from the filing requirements contained herein.

Exemption for Nature of Business

An insurer otherwise subject to the requirement and not eligible for an exemption as enumerated above may apply to its domiciliary commissioner for an exemption based on the nature of business written. This exemption is available to those companies writing property lines only.

Financial Hardship Exemption

(a) An insurer otherwise subject to this requirement and not eligible for an exemption as enumerated above may apply to the commissioner for a financial hardship exemption.

(b) Financial hardship is presumed to exist if the projected reasonable cost of the certification would exceed the lesser of:

(i) One percent of the insurer's capital and surplus reflected in the insurer's latest quarterly statement for the calendar year for which the exemption is sought; or

(ii) Three percent of the insurer's projected net direct plus assumed premiums written during the calendar year for which the exemption is sought as reflected in the insurer's latest quarterly statement filed with its domiciliary commissioner.

(5) Such a statement of opinion must consist of a paragraph identifying the actuary; a scope paragraph identifying the subjects on which an opinion is to be expressed and describing the scope of the actuary's work (see sections 8-11 below); and an opinion paragraph expressing his or her opinion with respect to such subjects (see sections 12-14 below). One or more additional paragraphs may be needed in individual cases if the actuary considers it necessary to state a qualification of his or her opinion or to explain some aspect of the annual statement which is not already sufficiently explained in the annual statement.

(6) The opening paragraph should generally indicate the actuary's relationship to the company. For a company actuary the opening paragraph of the actuarial opinion should contain the sentence:

> "I, (name and title of actuary), am an officer (employee) of (named insurer) and a member of the American Academy of Actuaries and meet its qualification standards. (and/or) I am a Fellow/Associate of the Casualty Actuarial Society."

For a consulting actuary, the opening paragraph of the actuarial opinion should contain the sentence:

> "I, (name and title of actuary, am associated with the firm of (name of firm). I am a member of the American Academy of Actuaries and meet its qualification standards. (and/or) I am a Fellow/Associate of the Casualty Actuarial Society. I have been retained by the (name of insurer) with regard to loss and loss adjustment expense reserves."

For a person other than a member of the American Academy of Actuaries or a member of the Casualty Actuarial Society, the opening paragraph of the opinion should contain the sentence:

> "I, (name and title), am an officer (employee) of (name of insurer), and I have demonstrated competency in loss reserving to the satisfaction of (regulatory official of domiciliary state)."
>
> or
>
> "I, (name and title of consultant), am associated with the firm of (name of firm). I have demonstrated competency in loss reserving to the satisfaction of (regulatory official of domiciliary state) and have been retained by the (name of insurer) with regard to loss and loss adjustment expense reserves."

(7) The following are examples, for illustrative purposes, of language which in typical circumstances would be included in the remainder of the statement of actuarial opinion. The illustrative language should be modified as needed to meet the circumstances of a particular case, and the actuary should in any case use language which clearly expresses his or her professional judgment.

(8) The scope paragraph should contain a sentence such as the following:

> "I have examined the actuarial assumptions and methods used in determining reserves listed below, as shown in the Annual Statement of the company as prepared for filing with state regulatory officials, as of December 31, 19__."

The paragraph should list those items and amounts with respect to which the actuary is expressing an opinion. The list should include but not necessarily be limited to:

(a) Reserve for unpaid losses (Page 3, Item 1)

(b) Reserve for unpaid loss adjustment expenses (Page 3, Item 2).

(c) Reserve for unpaid losses - Direct and Assumed (Schedule P, Part 1, Cols. 13 and 15).

(d) Reserve for unpaid loss adjustment expenses - Direct and Assumed (Schedule P, Part 1, Cols. 17 and 19).

(9) If the actuary has examined the underlying records and/or summaries, the scope paragraph should also include a sentence such as the following:

> "My examination included such review of the actuarial assumptions and methods used and of the underlying basic records and/or summaries and such tests of the calculations as I considered necessary."

(10) If the actuary has not examined the underlying records and/or summaries, but has relied upon those prepared by the company, the scope paragraph should include a sentence such as one of the following:

(a) "I relied upon underlying records and/or summaries prepared by the responsible officers or employees of the company or group to which it belongs. In other respects, my examination included such review of the actuarial assumptions and methods used and such tests of the calculations as I considered necessary."

(b) "I relied upon (name of accounting firm) for the accuracy of the underlying records and/or summaries. In other respects, my examination included such review of the underlying actuarial assumptions and methods used and such tests of the calculations as I considered necessary."

(11) The actuary should comment in the scope section, as appropriate, on relevant topics such as the following to the extent they affect, or could affect, the loss reserves; discounting, salvage/subrogation, loss portfolio transfers, financial reinsurance, and reinsurance collectibility. If the company reserves will create exceptional values using the NAIC IRIS tests, the actuary should include an explanation.

(12) The opinion paragraph should include a sentence which covers at least the points listed in the following illustration:

> "In my opinion, the amounts carried in the balance sheet on account of the items identified above

(a) are computed in accordance with accepted loss reserving standards and principles.

(b) make a reasonable provision for all unpaid loss and loss expense obligations of the Company under the terms of its policies and agreements.

(c) meet the requirements of the insurance laws of (state of domicile)."

(13) The actuary should describe the actuarial assumptions and/or methods which have been used. If there has been any material change in the actuarial assumptions and/or methods from those previously employed, that change should be described in the statement of actuarial opinion by inserting a phrase such as:

"A material change in actuarial assumptions (and/or methods) was made during the past year, but such change accords with accepted loss reserving standards."

A brief description of the change should follow.

The adoption of new issues or coverages requiring underlying actuarial assumptions which differ from actuarial assumptions used for prior issues or coverages is not a change in actuarial assumption within the meaning of this paragraph.

(14) If the actuary is unable to form an opinion, he or she should refuse to issue a statement of opinion. If the actuary's opinion is adverse or qualified, the actuary should issue an adverse or qualified actuarial opinion explicitly stating the reason(s) for such opinion.

(15) The statement must include assurance that workpapers supporting the actuarial opinion will be maintained at the company and available for examination for seven years. The wording for an actuary employed by the company should be similar to the following:

"Workpapers supporting the findings expressed in this statement of actuarial opinion will be retained for a period of seven years in the administrative offices of the company and available for regulatory examination."

The wording for a consulting actuary retained by the company should be similar to the following:

"Workpapers supporting the findings expressed in this statement of actuarial opinion have been provided to the company to be retained for a period of seven years at its administrative offices and available for regulatory examination."

(16) The statement should conclude with the signature of the actuary responsible for providing the opinion. The signature should appear in the following format:

____
Signature of actuary
Printed name of actuary
Address of actuary
Telephone number of actuary

Department of Insurance and Finance

21 LABOR AND INDUSTRIES BUILDING • SALEM, OREGON 97310

June 26, 1990

Mr. Robert Solitro
Director of Examinations
New Hampshire Insurance Department
169 Manchester Street
Concord, NH 03301

Re: Statement of Actuarial Opinion
Annual Statement Instructions for Property/Casualty Companies
Proposals from the Casualty Actuarial Task Force for 1991

Dear Bob:

The NAIC Casualty Actuarial Task Force recommends some changes to the Instructions relating to the Statement of Actuarial Opinion for property/casualty companies. For the most part, these have to do with the content of the statement and are needed for consistency with the changes adopted by the Blanks Task Force for 1990. We also recommend some substantive changes, which I wish to describe.

Paragraph (8): We want to add reserves for direct and assumed losses and loss adjustment expenses to the list of items for the scope paragraph to which the actuary is to express an opinion. Reserves on the direct and assumed basis represent the total potential liability should reinsurance agreements fail. Technical impairment on a direct and assumed basis should be of regulatory concern even if ceded loss reserves provide sufficient surplus relief.

New Paragraph (11): We want to insert a new requirement for the scope section for comment on items which could affect the loss reserves, such as: discounting (if and when permitted), salvage/subrogation, loss portfolio transfers, financial reinsurance, and reinsurance collectibility. These items are particularly relevant to the difference between direct and net reserves. Both regulators and industry representatives have expressed concern about the potential impact of these items on apparent solvency.

In addition, our task force recommends a required explanation from the actuary if the company reserves will cause exceptional values on the IRIS tests. This explanation should assist the examiner teams which review the IRIS results each year.

Paragraph (12): In the opening sentence of the opinion paragraph, the "fairly stated" phrase needs to be dropped. This is an accounting concept not translated into actuarial principles beyond "accepted loss reserving standards and principles," which is sufficient language.

We further recommend substituting the phrase "reasonable" for "good and sufficient," which seems to imply guaranteed adequacy despite all contingencies known or unknown. Actuaries facing the older phrase have expressed considerable discomfort with it. The term "reasonable" is preferred by most practicing actuaries as referring to an appropriate value based on all factors which are known or can be known at the current time--in other words, the best state-of-the-art estimate.

Our task force discussed other phrases such as "adequate" and "sufficient," but did not choose to use any other than current actuarial practice. Some members noted that section (iii) specifies that the opinion items must "meet the requirements of the insurance laws of" the state of domicile, which usually include a term such as "sufficient."

Paragraph (13): The actuary should describe the assumptions and methods used to determine the loss and expense reserves, rather than simply stating that any changes meet accepted standards. This will help us to evaluate the quality of efforts made to determine reserves and will help examiners interpret the workpapers.

New Paragraph (15): We recommend adding another paragraph or clause stating that workpapers supporting the opinion will be available at the company for examiners to review. A seven-year retention was selected to comfortably cover two triennial examinations.

New Paragraph (16): Finally, the signature line was just dangling at the end of the Instructions. We recommend a paragraph giving mention of it and also calling for a printed name, address, and phone number so we may easily contact the actuary directly.

With these revisions, we believe the Statement of Actuarial Opinion for property/casualty companies will be a useful tool for our efforts to monitor solvency.

Sincerely,

R. Michael Lamb, FCAS, MAAA
Casualty Actuary
Insurance Division
(503) 378-4271

RML:psm
7156u

Enclosure

12. (1) STATEMENT OF ACTUARIAL OPINION

There is to be included or attached to Page 1 of the Annual Statement, the statement of a qualified actuary, entitled "Statement of Actuarial Opinion," setting forth his or her opinion relating to loss and loss adjustment expense reserves.

(2) DEFINITIONS

"Qualified actuary" is a person who is either:

(a) A member in good standing of the Casualty Actuarial Society, or

(b) A member in good standing of the American Academy of Actuaries who has been approved as qualified for signing casualty loss reserve opinions by the Casualty Practice Council of the American Academy of Actuaries, or

(c) A person who otherwise has competency in loss reserve evaluation as demonstrated to the satisfaction of the insurance regulatory official of the domiciliary state. In such case, at least 90 days prior to the filing of its annual statement, the insurer must request approval that the person be deemed qualified and that request must be approved or denied. The request must include the NAIC Biographical form and a list of all loss reserve opinions and/or certifications issued in the last 3 years by this person.

Notwithstanding the above, a domiciliary commissioner may, by bulletin or regulation, specify who may sign an opinion. Also, a domiciliary commissioner may require particular qualifications, including independence, for specific insurers.

"Insurer" means an insurer authorized to write property and/or casualty insurance under the laws of any state and includes but is not limited to fire and marine companies, general casualty companies, local mutual aid societies, statewide mutual assessment companies, mutual insurance companies other than life, farm mutual insurance companies, county mutual insurance companies, Lloyd's plans, reciprocal and interinsurance exchanges, captive insurance companies, risk retention groups, stipulated premium insurance companies, and non-profit legal services corporations.

"Annual Statement" means the annual financial statement required to be filed by insurers with the commissioner.

(3) CONTENT

The opinion shall be in the format of and contain the information required by this Section 12 of the Annual Statement Instructions: Property and Casualty.

(4) EXEMPTIONS

A certified copy of the approved exemption must be filed with the annual statement in all jurisdictions in which the company is authorized.

Automatic Exemption

(a)[.] An insurer otherwise subject to the requirement that has less than $1,000,000 total direct plus assumed written premiums during a calendar year or that has less than a total of 1,000 policyholders and certificate holders at the end of a calendar year, in lieu of the certification required for the calendar year, may submit an affidavit under oath of an officer of the insurer that specifies that amount of direct plus assumed premiums written and the total number of policyholders and certificate holders.

(b)[.] An insurer who intends to file for an exemption under this section must submit a letter of intent to its domiciliary commissioner no later than December 1 of the calendar year for which the exemption is to be claimed. The commissioner may deny the exemption prior to December 31 of the same year if he deems the exemption inappropriate.

Exemption for Insurers under Supervision or Conservatorship

Unless ordered by the domiciliary commissioner, an insurer that is under supervision or conservatorship pursuant to statutory provision is exempt from the filing requirements contained herein.

Exemption for Nature of Business

An insurer otherwise subject to the requirement and not eligible for an exemption as enumerated above may apply to its domiciliary commissioner for an exemption based on the nature of business written. This exemption is available to those companies writing property lines only.

Financial Hardship Exemption

(a)[.] An insurer otherwise subject to this requirement and not eligible for an exemption as enumerated above may apply to the commissioner for a financial hardship exemption.

(b)[.] Financial hardship is presumed to exist if the projected reasonable cost of the certification would exceed the less[o]er of:

(i)[.] One percent of the insurer's capital and surplus reflected in the insurer's annual statement [filed with the board] for the calendar year for which the exemption is sought; or

(ii)[.]Three percent of the insurer's net direct plus assumed premiums written during the calendar year for which the exemption is sought as reflected in the insurer's annual statement filed with its domiciliary commissioner.

(5) Such a statement of opinion must consist of a paragraph identifying the actuary; a scope paragraph identifying the subjects on which an opinion is to be expressed and describing the scope of the actuary's work (see sections 8-[10]11 below); and an opinion paragraph expressing his or her opinion with respect to such subjects (see sections [11-13]12-14 below). One or more additional paragraphs may be needed in individual cases if the actuary considers it necessary to state a qualification of his or her opinion or to explain some aspect of the annual statement[s] which is not already sufficiently explained in the annual statement[s].

(6) The opening paragraph should generally indicate the actuary's relationship to the company. For a company actuary the opening paragraph of the actuarial opinion should contain the sentence:

> "I, (name and title of actuary), am an officer (employee) of (named insurer) and a member of the American Academy of Actuaries and meet its qualification standards. (and/or) I am a Fellow/Associate of the Casualty Actuarial Society."

For a consult[ant]ing actuary, the opening paragraph of the actuarial opinion should contain the sentence:

> "I, (name and title of actuary [consultant]), am associated with the firm of (name of firm). I am a member of the American Academy of Actuaries and meet its qualification standards. (and/or) I am a Fellow/Associate of the Casualty Actuarial Society. I [and] have been retained by the (name of insurer) with regard to loss and loss adjustment expense reserves."

For a person other than a member of the American Academy of Actuaries or a member of the Casualty Actuarial Society, the opening paragraph of the opinion should contain the sentence:

"I, (name and title), am an officer (employee) of (name of insurer), and I have demonstrated competency in loss reserving[."] to the satisfaction of (regulatory official of domiciliary state)."

or

"I, (name and title of consultant), am associated with the firm of (name of firm). I have demonstrated competency in loss reserving to the satisfaction of (regulatory official of domiciliary state) and have been retained by the (name of insurer) with regard to loss and loss adjustment expense reserves."

(7) The following are examples, for illustrative purposes, of language which in typical circumstances would be included in the remainder of the statement of actuarial opinion. The illustrative language should be modified as needed to meet the circumstances of a particular case, and the actuary should in any case use language which clearly expresses his or her professional judgment.

(8) The scope paragraph should contain a sentence such as the following:

"I have examined the actuarial assumptions and methods used in determining reserves listed below, as shown in the Annual Statement of the company as prepared for filing with state regulatory officials, as of December 31, 19__."

The paragraph should list those items and amounts with respect to which the actuary is expressing an opinion. The list should include but not necessarily be limited to:

[(i)] (a) Reserve for unpaid losses (Page 3, Item 1)

[(ii)] (b) Reserve for unpaid loss adjustment expenses (Page 3, Item 2).

(c) Reserve for unpaid losses - Direct and Assumed (Schedule P, Part 1, Cols. 13 and 15)

(d) Reserve for unpaid loss adjustment expenses - Direct and Assumed (Schedule P, Part 1, Cols. 17 and 19.

(9) If the actuary has examined the underlying records and/or summaries, the scope paragraph should also include a sentence such as the following:

"My examination included such review of the actuarial assumptions and methods used and of the underlying basic records and/or summaries and such tests of the [and] calculations as I considered necessary."

(10) If the actuary has not examined the underlying records and/or summaries, but has relied upon those prepared by the company, the scope paragraph should include a sentence such as one of the following:

[(i)] (a) "I relied upon underlying records and/or summaries prepared by the responsible officers or employees of the company or group to which it belongs. In other respects, my examination included such review of the actuarial assumptions and methods used and such tests of the calculations as I considered necessary."

[(ii)] (b) "I relied upon (name of accounting firm) for the accuracy of the underlying records and/or summaries. In other respects, my examination included such review of the underlying actuarial assumptions and methods used and such te[x]sts of the calculations as I considered necessary."

(11) The actuary should comment in the scope section, as appropriate, on relevant topics such as the following to the extent they affect, or could affect, the loss reserves: discounting, salvage/subrogation, loss portfolio transfers, financial reinsurance, and reinsurance collectibility. If the company reserves will create exceptional values using the NAIC IRIS tests, the actuary should include an explanation.

[(11)](12) The opinion paragraph should include a sentence which covers at least the points listed in the following illustration:

"In my opinion, the amounts carried in the balance sheet on account of the items identified above

[(i)] (a) are computed in accordance with accepted loss reserving standards and [are fairly stated in accordance with sound loss reserving] principles.

[(ii)] (b) make a reasonable provision for all unpaid loss and loss expense obligations of the Company under the terms of its policies and agreements. [are based on factors relevant to policy provisions.]

[(iii)] (c) meet the requirements of the insurance laws of (state of domicile)."

[(iv) make a good and sufficient provision for all unpaid loss and loss expense obligations of the Company under the terms of its policies and agreements."]

[(12)](13) The actuary should describe the actuarial assumptions and/or methods which have been used. If there has been any material change in the actuarial assumptions and/or methods from those previously employed, that change should be described in the statement of actuarial opinion by inserting a phrase such as:

> "A material change in actuarial assumptions (and/or methods) was made during the past year, but such change accords with accepted loss reserving standards."

A brief description of the change should follow.

The adoption of new issues or coverages requiring underlying actuarial assumptions which differ from actuarial assumptions used for prior issues or coverages is not a change in actuarial assumption within the meaning of this paragraph.

[(13)](14) If the actuary is unable to form an opinion, he or she should refuse to issue a statement of opinion. If the actuary's opinion is adverse or qualified, the actuary should issue an adverse or qualified actuarial opinion explicitly stating the reason(s) for such opinion.

(15) The statement must include assurance that workpapers supporting the actuarial opinion will be maintained at the company and available for examination for seven years. The wording for an actuary employed by the company should be similar to the following:

> "Workpapers supporting the findings expressed in this statement of actuarial opinion will be retained for a period of seven years in the administrative offices of the company and available for regulatory examination.

The wording for a consulting actuary retained by the company should be similar to the following:

> "Workpapers supporting the findings expressed in this statement of actuarial opinion have been provided to the company to be retained for a period of seven years at its administrative offices and available for regulatory examination.

(16) The statement should conclude with the signature of the actuary responsible for providing the opinion. The signature should appear in the following format:

____

Signature of actuary
Printed name of actuary
Address of actuary
Telephone number of actuary

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CONTROVERSIES IN THE FOUNDATION OF STATISTICS (REPRINT)

Bradley Efron

Controversies in the Foundations of Statistics

by Bradley Ephron

This lively and wide-ranging article explores the philosophical battles among Bayesians, classical statisticians (frequentists), and a third group, termed the Fisherians. At this writing, no clear winner has emerged, although the frequentists may currently have the upper hand.

The article gives examples of the approach to estimation of the mean of a distribution by each camp, and some problems with each approach. One section discusses Stein's estimator more rigorously than the Scientific American article by Ephron and Morris. Ephron speculates on the future of statistical theory.

This article will give you insight regarding the fundamental problems of statistics that affect your work (in particular, as regards credibility). The bases of some common actuarial methods are still controversial.

This article is presented as part of a program of reprinting important papers on the foundations of casualty actuarial science. It is reprinted with the generous permission of the Mathematical Association of America. It originally appeared in the American Mathematical Monthly, Volume 85, Number 4, April 1978, pages 231 to 246.

CONTROVERSIES IN THE FOUNDATIONS OF STATISTICS

BRADLEY EFRON

1. Introduction. Statistics seems to be a difficult subject for mathematicians, perhaps because its elusive and wide-ranging character mitigates against the traditional theorem-proof method of presentation. It may come as some comfort then that statistics is also a difficult subject for statisticians. We are now celebrating the approximate bicentennial of a controversy concerning the basic nature of statistics. The two main factions in this philosophical battle, the Bayesians and the frequentists, have

Bradley Efron received his Ph.D. in Statistics from Stanford in 1964 under the direction of Rupert Miller. He holds professorships at Stanford in both the Statistics Department and the Department of Preventive Medicine. His interests cover most of theoretical and applied statistics, with special emphasis on the application of geometrical methods to statistical problems. — *Editors* alternated dominance several times, with the frequentists currently holding an uneasy upper hand. A smaller third party, perhaps best called the Fisherians, snipes away at both sides.

Statistics, by definition, is uninterested in the special case. Averages are the meat of statisticians, where "average" here is understood in the wide sense of any summary statement about a large population of objects. "The average I.Q. of a college freshman is 109" is one such statement, as is "the probability of a fair coin falling heads is 1/2." The controversies dividing the statistical world revolve on the following basic point: just *which* averages are most relevant in drawing inferences from data? Frequentists, Bayesians, and Fisherians have produced fundamentally different answers to this question.

This article will proceed by a series of examples, rather than an axiomatic or historical exposition of the various points of view. The examples are artificially simple for the sake of humane presentation, but readers should be assured that real data are susceptible to the same disagreements. A counter-warning is also apt: these disagreements haven't crippled statistics, either theoretical or applied, and have as a matter of fact contributed to its vitality. Important recent developments, in particular the empirical Bayes methods mentioned in Section 8, have sprung directly from the tension between the Bayesian and frequentist viewpoints.

2. The normal distribution. All of our examples will involve the normal distribution, which for various reasons plays a central role in theoretical and applied statistics. A normal, or Gaussian, random variable x is a quantity which possibly can take on any value on the real axis, but not with equal probability. The probability that x falls in the interval $[a, b]$ is given by the area under Gauss' famous bell-shaped curve,

$$\text{Prob}\{a \leqq x \leqq b\} = \int_a^b \phi_{\mu,\sigma}(x)dx, \tag{2.1}$$

where

$$\phi_{\mu,\sigma}(x) = \frac{1}{\sqrt{2\pi}\sigma}\exp\left[-\frac{1}{2}\left(\frac{x-\mu}{\sigma}\right)^2\right]. \tag{2.2}$$

For convenience we indicate such a random variable by

$$x \sim \mathcal{N}(\mu, \sigma^2), \tag{2.3}$$

with σ^2 instead of σ as the second argument by convention.

Figure 1 illustrates the normal distribution. The high point of $\phi_{\mu,\sigma}(x)$ is at $x = \mu$, the curve falling off quickly for $|x - \mu| > \sigma$. Most of the probability, 99.7%, is within ± 3 σ-units of the central value μ. We can write $x \sim \mathcal{N}(\mu, \sigma^2)$ as $x = \mu + \varepsilon$, where $\varepsilon \sim \mathcal{N}(0, \sigma^2)$; adding the constant μ merely shifts $\varepsilon \sim \mathcal{N}(0, \sigma^2)$ μ units to the right.

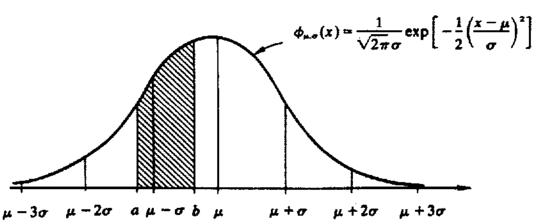

FIG. 1. The normal distribution. The random quantity $x \sim \mathcal{N}(\mu, \sigma^2)$ occurs in $[a, b]$ with probability equal to the shaded area. 68% of the probability is in the interval $[\mu-\sigma, \mu+\sigma]$, 95% in $[\mu-2\sigma, \mu+2\sigma]$, 99.7% in $[\mu-3\sigma, \mu+3\sigma]$.

The parameter μ is the "mean" or "expectation" of the random quantity x. Using "E" to indicate expectation,

$$\mu = E\{x\} \equiv \int_{-\infty}^{\infty} x\phi_{\mu,\sigma}(x)dx. \tag{2.4}$$

The reader may wish to think of $E\{g(x)\}$ for an arbitrary function $g(x)$ as just another notation for the integral of $g(x)$ with respect to $\phi_{\mu,\sigma}(x)dx$,

$$E\{g(x)\} \equiv \int_{-\infty}^{\infty} g(x)\phi_{\mu,\sigma}(x)dx. \tag{2.5}$$

Intuitively, $E\{g(x)\}$ is the weighted average of the possible values of $g(x)$, weighted according to the probabilities $\phi_{\mu,\sigma}(x)dx$ for the infinitesimal intervals $[x, x+dx]$. In other words, $E\{g(x)\}$ is a theoretical average of an infinite population of $g(x)$ values, where the x's occur in proportion to $\phi_{\mu,\sigma}(x)$.

It is easy to see, by symmetry, that μ is indeed the theoretical average of x itself when $x \sim \mathcal{N}(\mu, \sigma^2)$. A more difficult calculation (though easy enough for friends of the gamma function) gives the expectation of $g(x) = (x-\mu)^2$,

$$E\{(x-\mu)^2\} = \int_{-\infty}^{\infty} (x-\mu)^2\phi_{\mu,\sigma}(x)dx = \sigma^2. \tag{2.6}$$

The parameter σ, called the "standard deviation," sets the scale for the variability of x about the central value μ, as Figure 1 shows. A $\mathcal{N}(1, 10^{-6})$ random variable will have almost no perceptible variability under repeated trials, 997 out of 1000 repetitions occurring in [.997, 1.003], since $\sigma = 10^{-3}$. A $\mathcal{N}(1, 10^{6})$ random variable is almost all noise and no signal, in the evocative language of communications theory.

The normal distribution has a very useful closure property that makes it as easy to deal with many observations as with a single one. Let $x_1, x_2, x_3, \ldots, x_n$ be n independent observations, each of which is $\mathcal{N}(\mu, \sigma^2)$, μ and σ being the same for all n repetitions. Independence means that the value of x_1, say, does not affect any of the other values: observing $x_1 > \mu$ does not increase or decrease the 34% probability that $x_2 \in [\mu, \mu+\sigma]$, etc. A familiar (non-normal) example of independent variables $x_1, x_2, x_3, \ldots$ is given by successive observations of a well-rolled die.

Let

$$\bar{x} \equiv \sum_{i=1}^{n} x_i/n \tag{2.7}$$

be the observed average of the n independent $\mathcal{N}(\mu, \sigma^2)$ variables. It is easy to show that

$$\bar{x} \sim \mathcal{N}(\mu, \sigma^2/n). \tag{2.8}$$

The distribution of $\bar{x}$ is the same as that for the individual x_i except that the scaling parameter has been reduced from σ to $\sigma/\sqrt{n}$. By taking n sufficiently large we can reduce the variability of $\bar{x}$ about μ to an arbitrarily small level, but of course in real problems n is limited and $\bar{x}$ retains an irreducible component of random variability.

In all of our examples σ will be assumed known to the statistician. The unknown parameter μ will be the object of interest, the goal being to make inferences about the value of μ on the basis of the data $x_1, x_2, x_3, \ldots, x_n$. In 1925 Sir Ronald Fisher made the fundamental observation that in this situation ***the average $\bar{x}$ contains all possible information about μ***. For any inference problem about μ, knowing $\bar{x}$ is just as good as knowing the entire data set $x_1, x_2, x_3, \ldots, x_n$. In modern parlance, $\bar{x}$ is a "sufficient statistic" for the unknown parameter μ.

It is easy to verify sufficiency in this particular case. Given the observed value of $\bar{x}$, a standard probability calculation shows that the random quantities $x_1 - \bar{x}, x_2 - \bar{x}, x_3 - \bar{x}, \ldots, x_n - \bar{x}$ have a joint distribution which does not depend in any way on the unknown parameter μ. In other words, what's left over in the data after the statistician learns $\bar{x}$ is devoid of information about μ. (This deceptively simple principle eluded both Gauss and Laplace!)

3. Frequentist estimation of the mean. The statistician may wish to estimate the unobservable parameter μ on the basis of the observed data $x_1, x_2, x_3, \ldots, x_n$. "Estimate" usually means "make a guess $\hat{\mu}(x_1, x_2, x_3, \ldots, x_n)$ depending on $x_1, x_2, \ldots, x_n$, with the understanding that you will be penalized an amount which is a smooth increasing function of the error of estimation $|\hat{\mu} - \mu|$." The usual penalty function, which we shall also use here, is $(\hat{\mu} - \mu)^2$, the squared-error loss function originally introduced by Gauss.

Fisher's sufficiency principle says that we need only consider estimation rules which are a function of $\bar{x}$. The most obvious candidate is $\bar{x}$ itself,

$$\hat{\mu}(x_1, x_2, \ldots, x_n) = \bar{x}. \tag{3.1}$$

This estimation rule is "unbiased" for μ; no matter what the true value of μ is,

$$E\bar{x} = \mu. \tag{3.2}$$

Unbiasedness is by no means a necessary condition for a good estimation rule, as we shall see later, but it does have considerable intuitive appeal as a guarantee that the statistician is not trying to slant the estimation process in favor of any particular μ value.

The expected penalty for using $\hat{\mu} = \bar{x}$ is, according to (2.6) and (2.8),

$$E(\hat{\mu} - \mu)^2 = \sigma^2/n. \tag{3.3}$$

Gauss showed that among all unbiased estimation rules $\hat{\mu}(x_1, x_2, \ldots, x_n)$ which are linear in $x_1, x_2, x_3, \ldots, x_n$, the rule $\hat{\mu} = \bar{x}$ uniformly minimizes $E(\hat{\mu} - \mu)^2$ for every value of μ. In the early 1940's this result was extended to include any unbiased estimator at all, linear or nonlinear. The proof, which depends on ideas Fisher developed in the 1920's, was put forth separately by H. Cramér in Sweden and C. R. Rao in India.

If we agree to abide by the unbiasedness criterion and to use squared-error loss, $\bar{x}$ seems to be the best estimator for μ. It is helpful for the statistician to provide not only a "point estimator" for μ, $\bar{x}$ in this case, but also a range of plausible values of μ consistent with the data. From (2.8) and Figure 1 we see that

$$\text{Prob}\{|\bar{x} - \mu| \leqq 2\sigma/\sqrt{n}\} = .95, \tag{3.4}$$

which is equivalent to the statement

$$\text{Prob}\{\bar{x} - 2\sigma/\sqrt{n} \leqq \mu \leqq \bar{x} + 2\sigma/\sqrt{n}\} = .95. \tag{3.5}$$

The interval $[\bar{x} - 2\sigma/\sqrt{n}, x + 2\sigma/\sqrt{n}]$ is called a "95% confidence interval" for μ. The theory of confidence intervals was developed by J. Neyman in the early 1930's. As an example, suppose $n = 4$, $\sigma = 1$, and we observe $x_1 = 1.2$, $x_2 = 0.3$, $x_3 = 0.7$, $x_4 = 0.2$. Then $\bar{x} = 0.6$ and the 95% confidence interval for μ is $[-.04, 1.6]$.

All of this seems so innocuous and straightforward that the reader may wonder where the grounds for controversy lie. The fact is that all of the results presented so far are "frequentist" in nature. That is, they relate to theoretical averages with respect to the $\mathcal{N}(\mu, \sigma^2/n)$ distribution of $\bar{x}$, with μ assumed fixed at its true value, whatever that may be. Unbiasedness itself is a frequentist concept; the theoretical average of $\hat{\mu}$ with μ held fixed, $E\hat{\mu}$, equals μ. Results (3.3) and (3.5), and the Cramér–Rao theorem, are frequentist statements. For example, the proper interpretation of (3.5) is that the interval $[\bar{x} - 2\sigma/\sqrt{n}, \bar{x} + 2\sigma/\sqrt{n}]$ covers the true value of μ with frequency 95% in a long series of independent repetitions of $\bar{x} \sim \mathcal{N}(\mu, \sigma^2/n)$.

Nobody doubts that these results are true. The question raised by Bayesians and Fisherians is whether frequentist averages are really relevant to the process of inference scientists use in reasoning from noisy data back to the underlying mathematical models. We turn next to the Bayesian point of view.

4. Bayesian estimation of the mean. So far we have considered μ to be a fixed, albeit unknown, quantity. Suppose though that μ itself is a random variable, known to have the normal distribution with mean m and standard deviation s,

$$\mu \sim \mathcal{N}(m, s^2), \tag{4.1}$$

m and s being constants known to the statistician. For example, if μ is the true I.Q. of a person randomly chosen from the population of the United States, (4.1) holds with $m = 100$ and $s = 15$ (approximately). About 68% of I.Q.'s are between 85 and 115, about 95% between 70 and 130, etc. Information like (4.1), a "prior distribution for μ" in the language of the Bayesians, changes the nature of the estimation process.

Standard I.Q. tests are constructed so that if we test our randomly chosen person to discover his particular μ value, the overall test score*, say $\bar{x}$, is an unbiased normally distributed estimator of μ as in Section 3,

$$\bar{x} \mid \mu \sim \mathcal{N}(\mu, \sigma^2/n), \tag{4.2}$$

with $\sigma/\sqrt{n}$ about 7.5. We can expect $\bar{x}$ to be within 7.5 I.Q. points of μ 68% of the time, etc. The notation "$\bar{x} \mid \mu$" emphasizes that the $\mathcal{N}(\mu, \sigma^2/n)$ distribution for $\bar{x}$ is *conditional* on the particular value taken by the random quantity μ. The reason for this change in notation will be made clearer soon.

Bayes' theorem, originally discovered by the remarkable Reverend Thomas Bayes around 1750, is a mathematical formula for combining (4.1) and (4.2) to obtain the conditional distribution of μ given $\bar{x}$. In this case the formula gives

$$\mu \mid \bar{x} \sim \mathcal{N}(m + C(\bar{x} - m), D), \tag{4.3}$$

where

$$C = \frac{n/\sigma^2}{1/s^2 + n/\sigma^2} \quad \text{and} \quad D = \frac{1}{1/s^2 + n/\sigma^2}. \tag{4.4}$$

For example, if $\bar{x} = 160$ (and $m = 100$, $s = 15$, $\sigma/\sqrt{n} = 7.5$) then

$$\mu \mid \bar{x} \sim \mathcal{N}(148, (6.7)^2). \tag{4.5}$$

Expression (4.5), or more generally (4.3), is the "posterior distribution for μ given the observed value of $\bar{x}$." It is possible to make such a statement in the Bayesian framework because we start out assuming that μ itself is random. In the Bayesian framework the averaging process is reversed; the data $\bar{x}$ is assumed fixed at its observed value while it is the parameter μ which varies. In (4.5) for example, the conditional average of μ given $\bar{x} = 160$ is seen to be 148. If we randomly selected an enormous number of people, gave them each an I.Q. test, and considered the subset of those who scored 160, this subset would have an average true I.Q. of 148; 68% of the true I.Q.'s would be in the interval $[148 - 6.7, 148 + 6.7]$, etc.

How should we estimate μ in the Bayesian situation? It seems natural to use the estimator $\mu^*(\bar{x})$ which minimizes the conditional expectation of $(\mu - \mu^*)^2$ *given the observed value of* $\bar{x}$. From (4.3) it is

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* The symbols $\bar{x}$ for the test score and $\sigma/\sqrt{n}$ for its standard deviation are chosen to agree with our previous notation, even though real I.Q. scores aren't actually the average of n independent test items. Perfect normality, as expressed in (4.2), is an ideal only approximated by actual test scores.

easy to derive that this "Bayes estimator" is

$$\mu^*(\bar{x}) = m + C(\bar{x} - m), \tag{4.6}$$

the mean of the posterior distribution of μ given $\bar{x}$. Having observed $\bar{x} = 160$, the Bayes estimate is 148, not 160. Even though we are using an unbiased I.Q. test, so many more true I.Q.'s lie below 160 rather than above that it lowers the expected estimation error to bias the observed score toward 100. Figure 2 illustrates the situation.

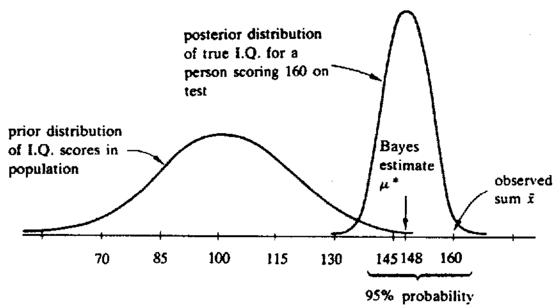

FIG. 2. I.Q. scores have a $\mathcal{N}(100,(15)^2)$ distribution in the population as a whole. A randomly selected person scoring 160 on a normal unbiased I.Q. test with standard deviation 7.5 points is estimated to have a true I.Q. of 148. The probability is 95% that the person's true I.Q. is in the interval [134.6, 161.4].

Confidence intervals have an obvious Bayesian analogue, from (4.3),

$$\text{Prob}\{\mu^*(\bar{x}) - 2\sqrt{D} \leqq \mu \leqq \mu^*(\bar{x}) + 2\sqrt{D} \mid \bar{x}\} = .95. \tag{4.7}$$

The notation $\text{Prob}\{\cdot \mid \bar{x}\}$ indicates probability conditional on the observed value of $\bar{x}$. In the I.Q. example, $\text{Prob}\{134.6 \leqq \mu \leqq 161.8 \mid \bar{x} = 160\} = .95$.

Nobody (well, almost nobody) disagrees with the use of Bayesian methods in situations like the I.Q. problem where there is a clearly defined and well-known prior distribution for μ. The Bayes theory, as we shall see, offers some striking advantages in clarity and consistency. These advantages are due to the fact that Bayesian averages involve only the data value $\bar{x}$ actually seen, rather than a collection of theoretically possible other $\bar{x}$ values.

Difficulties and controversies arise because Bayesian statisticians wish to use Bayesian methods when there is no obvious prior distribution for μ, or going even further, when it is clear that the unknown μ is a fixed constant with no random character at all. (For example, if μ is some physical constant, such as the speed of light, being experimentally estimated.) It is not perversity that motivates this Bayesian impulse, but rather a well-documented casebook of unpleasant inconsistencies in the frequentist approach.

As an example of the kind of difficulties frequentists experience, let us reconsider the I.Q. estimation problem, but without assuming knowledge of the prior distribution (4.1) for μ. In other words, assume only that we observe $\bar{x} \sim \mathcal{N}(\mu, \sigma^2/n)$, $\sigma/\sqrt{n} = 7.5$, and wish to estimate μ. Having observed $\bar{x} = 160$, the results of Section 3 tell us to estimate μ by $\hat{\mu} = 160$, with 95% confidence interval $[\hat{\mu} - 2\sigma/\sqrt{n}, \hat{\mu} + 2\sigma/\sqrt{n}] = [145, 175]$.

Suppose now that the frequentist receives a letter from the company which administered the I.Q. test: "On the day the score of $\bar{x} = 160$ was reported, our test-grading machine was malfunctioning. Any score $\bar{x}$ below 100 was reported as 100. The machine functioned perfectly for scores $\bar{x}$ above 100."

It may seem that the frequentist has nothing to worry about, since the score he received, $\bar{x} = 160$, was correctly reported. However, the reason he is using $\hat{\mu} = \bar{x}$ to estimate μ is that it is the best unbiased estimator. The malfunction of the grading machine implies that $\hat{\mu}$ is no longer even unbiased!

If the true value of μ equals 100, the machine functioning as described in the letter produces $E\bar{x} = 103$, a bias of $+3$ points. To regain unbiasedness the frequentist must replace the estimation rule $\hat{\mu} = \bar{x}$ with $\hat{\mu}' = \bar{x} - \Delta(\bar{x})$, where the function $\Delta(\bar{x})$ is chosen to remove the bias caused by the machine malfunction.

The correction term $\Delta(\bar{x})$ will be tiny for $\bar{x} = 160$, but it is disturbing that any change at all is necessary. The letter from the grading company contained no new information about the score actually reported, or about I.Q.'s in general. It only concerned something bad that might have happened but didn't. Why should we change our inference about the true value of μ? Bayesian methods are free from this defect; the inferences they produce depend only on the data value $\bar{x}$ actually observed, since Bayesian averages such as (4.6), (4.7) are conditional on the observed $\bar{x}$.

How can a Bayesian analysis proceed in the absence of firm prior knowledge like (4.1)? Two different approaches are in use. The "subjectivist" branch of Bayesian statistics attempts to assess the statistician's subjective probability distribution for the unknown parameter μ, before the data is collected, by a series of hypothetical wagers. These wagers are of the form "would you be willing to bet even money that $\mu > 85$ versus $\mu \leqq 85$? Would you be willing to bet two-to-one that $\mu < 150$ versus $\mu \geqq 150$?..." The work of L. J. Savage and B. deFinetti shows that a completely rational person should always be able to arrive at a unique (for himself) prior distribution on μ by sufficiently prolonged self-interrogation.

The subjectivist approach can be very fruitful in cases where the statistician (usually in collaboration with the experimenter, of course) has some vague prior opinions about the true value of μ, which he is trying to update on the basis of the observed data $\bar{x}$. Because it is subjective, the method is not much used where objectivity is the prime consideration, for example in the publication of controversial new scientific results.

Another line of Bayesian thought, which might be (but usually isn't) called "objective Bayesianism," attempts, in the absence of prior knowledge, to produce a prior distribution that everyone would agree represents a completely neutral prior opinion about μ. In the I.Q. problem, such a "flat" prior might take the form $\mu \sim \mathcal{N}(0, \infty)$, whereby we mean $\mu \sim \mathcal{N}(0, s^2)$ with s^2 going to infinity. From (4.3), (4.4) we get

$$\mu \mid \bar{x} \sim \mathcal{N}(\bar{x}, \sigma^2/n). \tag{4.8}$$

This result has a lot of appeal. The Bayes estimator μ^* equals the frequentist estimator $\hat{\mu} = \bar{x}$. The 95% Bayes probability interval (4.7) is the same as the 95% frequentist confidence interval (3.5). Moreover, because (4.8) is a Bayesian statement, the letter from the I.Q. testing company has no effect on it. We seem to be enjoying the best of both the frequentist and Bayesian worlds.

An enormous amount of effort has been expended in codifying the objective Bayesian point of view. Bayes himself put forth this approach (apparently with considerable reservations—his paper appeared posthumously and only through the efforts of an enthusiastic friend) which was adopted unreservedly by Laplace. It fell into disrepute in the early 1900's, and has since been somewhat revived by the work of Harold Jeffreys. One difficulty is that a "flat" prior distribution for μ is not at all flat for μ^3, say, so expressing ignorance seems to depend on which function of the unknown parameter one is interested in. A more pernicious difficulty is discussed in Section 8; in problems involving the estimation of several unknown parameters at once, what appears to be an eminently neutral prior distribution turns out to imply undesirable assumptions about the parameters.

5. Fisherian estimation of the mean. Ronald Fisher was one of the principal architects of frequentist theory. However, he was a lifelong critic, often vehemently so, of the standard frequentist approach. His criticisms moved along the same lines as those of the Bayesians: why should we be interested in theoretical averages concerning what happens if infinitely many $\bar{x}$ values are randomly generated from $\mathcal{N}(\mu, \sigma^2/n)$, with μ fixed? We only have one observed value of $\bar{x}$ in any one inference problem, and the inference process should concentrate on just that observed value.

Fisher was also opposed to the Bayesian approach, perhaps because the type of data analysis problems he met in his agricultural and genetical work were not well suited to the assessment of prior distributions. With characteristic ingenuity he produced another form of inference, neither Bayesian nor frequentist.

The relation $\bar{x} \sim \mathcal{N}(\mu, \sigma^2/n)$ may be written

$$\bar{x} = \mu + \varepsilon, \qquad \varepsilon \sim \mathcal{N}(0, \sigma^2/n). \tag{5.1}$$

We obtain the observation $\bar{x}$ by adding normal noise, $\varepsilon \sim \mathcal{N}(0, \sigma^2/n)$, to the unobservable mean μ. Expression (5.1) can also be written as

$$\mu = \bar{x} - \varepsilon. \tag{5.2}$$

It is obvious, or at least was obvious to Fisher, that in a situation where we know nothing a priori about μ, observing $\bar{x}$ tells us nothing about ε. As a matter of fact, said Fisher, if we can learn something about ε from $\bar{x}$ then model (5.1) by itself must be missing some important aspect of the statistical situation. We shall see this argument again, in more concrete form, in the next section.

If $\varepsilon \sim \mathcal{N}(0, \sigma^2/n)$ then $-\varepsilon \sim \mathcal{N}(0, \sigma^2/n)$ because of the symmetry of the bell-shaped curve about its central point. Fisher's interpretation of (5.2) was

$$\mu \mid \bar{x} \sim \mathcal{N}(\bar{x}, \sigma^2/n). \tag{5.3}$$

This looks just like the objectivist Bayesian statement (4.8), but has been obtained without recourse to prior distributions on μ. The interval statement following from (3.3) is

$$\text{Prob}\{\bar{x} - 2\sigma/\sqrt{n} \leqq \mu \leqq \bar{x} + 2\sigma/\sqrt{n} \mid \bar{x}\} = .95. \tag{5.4}$$

This is a "fiducial" probability statement, in Fisher's terminology.

In the fiducial argument randomness resides neither in the data $\bar{x}$, as in frequentist calculations, nor in μ, as in Bayesian calculations. Rather it lies in the mechanism which transforms the unobservable μ to the observed $\bar{x}$. (In the case at hand, this mechanism is the addition of $\varepsilon \sim \mathcal{N}(0, \sigma^2/n)$ to μ.) Fiducial statements such as (5.4) are obtained as averages over the random transformation mechanism.

The fiducial argument has fallen out of favor since its heyday in the 1940's. Most, though not all, contemporary statisticians consider it either a form of objective Bayesianism, or just plain wrong. Applied to the simultaneous estimation of several parameters, the fiducial argument can lead to disaster, as shown in Section 8.

Lest the reader feel sorry for Fisher, two other of his novel ideas on averaging, conditional inference and randomization, are still very much in vogue, and are the subjects of the next two sections.

6. Conditional inference. We return to the frequentist point of view, but with a twist, "conditioning," introduced by Fisher in 1934. Conditional inference illustrates another major source of ambiguity in the frequentist methodology, the choice of the collection of theoretically possible data values averaged over to obtain a frequentist inference.

Suppose again that we have independent normal variables $x_1, x_2, x_3, \ldots, x_n$, each $x_i \sim \mathcal{N}(\mu, \sigma^2)$, but that before observation begins the number n is randomly selected by the flip of a fair coin,

$$n = \begin{cases} 10 & \\ & \text{with probability} \\ 100 & \end{cases} \begin{matrix} 1/2 \\ \\ 1/2. \end{matrix} \tag{6.1}$$

We still wish to estimate μ on the basis of the data $x_1, x_2, x_3, \ldots, x_n$, and n with σ a known constant as before.

The conditional distribution of $\bar{x}$ *given the observed value of* n is

$$\bar{x} \mid n \sim \mathcal{N}(\mu, \sigma^2/n) \tag{6.2}$$

as at (2.8). The observed average $\bar{x}$ by itself is not a sufficient statistic in this situation. We also need to know whether n equals 10 or 100. Without this knowledge we still have an unbiased estimator of μ, namely $\hat{\mu} = \bar{x}$, but we don't know the standard deviation of $\hat{\mu}$.

What is the expected squared error of $\hat{\mu} = \bar{x}$ in this situation? Averaging (3.3) over the two values of n gives

$$E(\hat{\mu} - \mu)^2 = \frac{1}{2}\frac{\sigma^2}{10} + \frac{1}{2}\frac{\sigma^2}{100}. \tag{6.3}$$

Fisher pointed out that this is a ridiculous calculation. It is obviously more appropriate to assess the accuracy of $\hat{\mu}$ conditional on the value of n actually observed,

$$E\{(\hat{\mu} - \mu)^2 \mid n\} = \begin{cases} \sigma^2/10 & \text{if} \quad n = 10 \\ \sigma^2/100 & \text{if} \quad n = 100. \end{cases} \tag{6.4}$$

There is nothing wrong with (6.3), except that the average squared error it computes is irrelevant to any particular value of n and $\bar{x}$ actually observed! If $n = 100$ then (6.3) is much too pessimistic about the accuracy of $\hat{\mu}$, while if $n = 10$ it is much too optimistic.

This may all seem so obvious that it is hardly worth saying. Fisher's surprise was to show that exactly the same situation arises, more subtly, in other problems of statistical inference. We will illustrate this with an example involving the estimation of two different normal means, say μ_1 and μ_2, on the basis of independent unbiased normal estimates for each of them,

$$\bar{x}_1 \sim \mathcal{N}(\mu_1, 1), \qquad \bar{x}_2 \sim \mathcal{N}(\mu_2, 1), \tag{6.5}$$

$\bar{x}_1$ and $\bar{x}_2$ independent of each other. (For simplicity we have assumed that both estimates have $\sigma^2/n = 1$.) The two dimensional data vector $(\bar{x}_1, \bar{x}_2)$ can take on any value in the plane, but with high probability lies no more than a few units away from the vector of means (μ_1, μ_2).

Given no further information we would probably estimate (μ_1, μ_2) by $(\bar{x}_1, \bar{x}_2)$. (But see Section 8!) However, we now add the assumption that (μ_1, μ_2) is known to lie on the circle of radius 3 centered at the origin,

$$(\mu_1, \mu_2) = 3(\cos\theta, \sin\theta) \qquad -\pi < \theta \leqq \pi. \tag{6.6}$$

The statistical problem, as illustrated in Figure 3, is to estimate the unknown parameter θ on the basis of $(\bar{x}_1, \bar{x}_2)$.

Let us indicate the polar coordinates of $(\bar{x}_1, \bar{x}_2)$ by

$$\hat{\theta} = \arctan(\bar{x}_2/\bar{x}_1), \qquad r = \sqrt{\bar{x}_1^2 + \bar{x}_2^2}. \tag{6.7}$$

Then $\hat{\theta}$ is the obvious estimator of θ. It is unbiased, $E\hat{\theta} = \theta$, with expected squared error

$$E(\hat{\theta} - \theta)^2 = .12 \tag{6.8}$$

(obtained by numerical integration; (6.8) makes the convention that $\hat{\theta} - \theta$ ranges from $-\pi$ to π for any value of θ, the largest possible estimation error occurring if $(\bar{x}_1, \bar{x}_2)$ is antipodal to (μ_1, μ_2). This convention is unimportant because the probability of $|\hat{\theta} - \theta| > \pi/2$ is only .0014).

The unobvious fact pointed out by Fisher is that r plays the same role as did "n" in examples (6.1)–(6.4).

(i) The distribution of r does not depend on the true value of θ. (For readers familiar with the

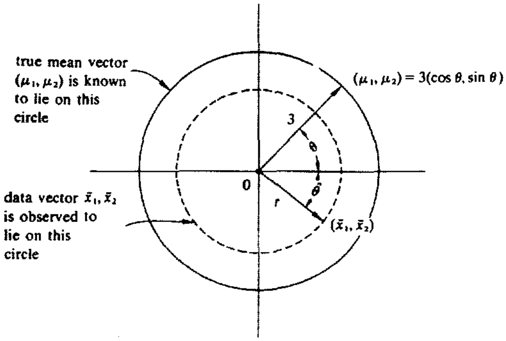

FIG. 3. The model $\bar{x}_1 \sim \mathcal{N}(\mu_1, 1)$ independent of $\bar{x}_2 \sim \mathcal{N}(\mu_2, 1)$, with (μ_1, μ_2) known to lie on a circle of radius 3 centered at the origin. We wish to estimate the angular location θ of (μ_1, μ_2) on the circle. The data vector $(\bar{x}_1, \bar{x}_2)$ is observed to have polar coordinates $(\hat{\theta}, r)$.

bivariate normal density, this follows from the circular symmetry of the distribution (6.5) of $(\bar{x}_1, \bar{x}_2)$ about (μ_1, μ_2).)

(ii) If r is small, then $\hat{\theta}$ has less accuracy than (6.8) indicates, while if r is large then $\hat{\theta}$ has greater accuracy that (6.8) indicates. Table 1 shows the conditional expected squared error $E\{(\hat{\theta}-\theta)^2 | r\}$ as a function of r.

In Fisher's terminology, r is an "ancillary" statistic. It doesn't directly contain information about θ, because of property (i), but its value determines the accuracy of $\hat{\theta}$. It now seems obvious that we should condition our assessment of the accuracy of $\hat{\theta}$ on the observed value of r. If $r = 2$, as in Figure 3, then $E\{(\hat{\theta}-\theta)^2 | r\} = .18$ is more relevant to the accuracy of $\hat{\theta}$ than is the unconditional expectation $E(\hat{\theta}-\theta)^2 = .12$.

r	1.5	2	2.5	3	3.5	4	4.5	5	Unconditional Value $E(\hat{\theta}-\theta)^2$
$E\{(\hat{\theta}-\theta)^2 \| r\}$	.26	.18	.14	.12	.10	.09	.08	.07	.12

TABLE 1. The conditional expected squared error of estimation in the circle problem, $E\{(\hat{\theta}-\theta)^2 | r\}$, as a function of the ancillary statistic $r = \sqrt{\bar{x}_1^2 + \bar{x}_2^2}$. The accuracy of $\hat{\theta}$ improves as r increases. Fisher argued that $E\{(\hat{\theta}-\theta)^2 | r\}$ is a more relevant measure of the accuracy of $\hat{\theta}$ than is the unconditional expectation $E(\hat{\theta}-\theta)^2$.

Many real statistical problems have the property that some data values are obviously more informative than others. Conditioning is the intuitively correct way to proceed, but few situations are as clearly structured as the circle problem. Sometimes more than one ancillary statistic exists, and the same data value will yield different accuracy estimates depending on which ancillary is conditioned upon. More often no ancillary exists, but various approximate ancillary statistics suggest themselves. What the circle example reveals is that frequentist statements like (6.8) may be true but irrelevant. Fisher's point was that the theoretical average of $(\hat{\theta}-\theta)^2$ should be taken not over all possible data values, but only over those containing the same amount of information for θ. So far it has proved impossible to codify this statement in a satisfactory way.

A Bayesian would agree that it is correct to condition one's opinion of the accuracy of $\hat{\theta}$ on the observed value of r, but would ask why not go further and condition on the observed value of $(\bar{x}_1, \bar{x}_2)$ itself. This is impossible in the frequentist framework, since if we reduce our averaging set to one data point, there is nothing left to average over. Bayesian inferences are always conditional on the data point actually observed. In the circle problem the natural flat prior is a uniform distribution on $\theta \in [-\pi, \pi]$. With this prior distribution it turns out that $E\{(\theta - \hat{\theta})^2 | (\bar{x}_1, \bar{x}_2)\}$ equals $E\{(\hat{\theta} - \theta)^2 | r = \sqrt{\bar{x}_1^2 + \bar{x}_2^2}\}$ as given in Table 1, so in this particular case the objective Bayesian and conditional frequentist points of view agree. (Notice that in the first expectation "θ" is the random quantity, while in the second it is "$\hat{\theta}$" which varies.)

7. **Randomization.** Randomization is yet another form of inferential averaging introduced by R. A. Fisher. In order to discuss it simply we must change statistical problems, from estimation theory to "hypothesis testing." The data are now in the form of $2n$ independent normal observations $x_1, x_2, x_3, \ldots, x_n, y_1, y_2, y_3, \ldots, y_n$,

$$x_i \sim \mathcal{N}(\mu_1, \sigma^2), \qquad y_i \sim \mathcal{N}(\mu_2, \sigma^2) \qquad i = 1, 2, \ldots, n, \tag{7.1}$$

with σ known, μ_1 and μ_2 unknown. We wish to test the "null hypothesis" that $\mu_2 = \mu_1$ versus the "alternative hypothesis" that $\mu_2 > \mu_1$, often written

$$H: \mu_2 = \mu_1 \quad \text{versus} \quad A: \mu_2 > \mu_1. \tag{7.2}$$

(For our purposes, $\mu_2 < \mu_1$ is assumed impossible.)

In hypothesis testing the null hypothesis H usually plays the role of a devil's advocate which the experimenter is trying to disprove. For example, the x's may represent responses to an old drug and the y's responses to a new drug that the experimenter hopes is an improvement. Because there is a vested interest in discrediting H, conservative statistical methods have been developed which demand a rather stiff level of evidence before H is declared invalid. The frequentist theory, which is dominant in hypothesis testing, accomplishes this by requiring that the probability of falsely rejecting H in favor of A, when H is true, be held below a certain small level, usually .05. A test satisfying this criterion is said to be ".05 level" for testing H versus A.

With the data as in (7.1) it seems natural to compute $\bar{x} = \Sigma_1^n x_i / n$, $\bar{y} = \Sigma_1^n y_i / n$, and reject H in favor of A if

$$\bar{y} - \bar{x} > c. \tag{7.3}$$

The constant c is chosen so that if H is true then $\text{Prob}\{\bar{y} - \bar{x} > c\} = .05$. Standard probability calculations show that $c = 2.326 \cdot \sigma / \sqrt{n}$ is the correct choice. The theory of optimal testing developed by J. Neyman and E. Pearson around 1930 shows that (7.3) is actually the best .05 level test of H versus A, in the sense that if A is actually true then the probability of rejecting H in favor of A is maximized.

The x's and y's we observe are actually measurements on some sort of experimental units, perhaps college freshmen or white mice or headache victims. Let us denote these units by $U_1, U_2, U_3, \ldots, U_{2n}$. The opportunity for randomization arises when we have an experiment in which we can decide beforehand which n of the units are to be x's, and which n are to be y's. If we are lazy we can just give the first n units we happen to have at hand the x treatment and the last n the y treatment. This is begging for disaster! The first n headache victims may be those with the worst headaches, the first n mice those in the cage with the heavier animals, etc. An experiment done in the lazy way may have probability of falsely rejecting the null hypothesis much greater than .05 because of such uncontrolled factors.

In his vastly influential work on experimental design, Fisher argued that the choice of experimental units be done by randomization. That is, the assignment of the n units to the x treatment group and the n units to the y treatment group be done with equal probability for each of the $(2n!)/(n!)^2$ such assignments. A random number generating device is used to carry out the randomization process.

Fisher pointed out that randomized studies were likely to be free of the type of experimental biases discussed above. Suppose for example that there is some sort of "covariate" connected with the experimental units, by which we mean a quantity which is thought to affect the observation on that unit no matter which treatment is given. For example, weight might be an important covariate for the white mice. Heavy mice might respond less well to the stimulus than light mice. If n is reasonably large, say 10, it is very unlikely that the randomized experiment will have all the heavy mice in the x group and the light mice in the y group. This statement applies equally to every covariate, whether or not we know it affects the response, and even if we are unaware of its existence.

None of this has anything to do with averaging. The connection comes through Fisher's next suggestion: that we compute theoretical averages not over the hypothesized normal distributions, but instead over the randomization process itself. Suppose that if all $2n$ experimental units had received treatment x, the observations would have been $X_1, X_2, \ldots, X_{2n}$, X_i being the observation on unit U_i. The capital letters indicate that these are hypothetical observations and not necessarily the observed data. Under the null hypothesis H, treatment y is the same as treatment x, so we can indeed consider all $2n$ units to have received treatment x. In this case the observed data $x_1, x_2, \ldots, x_n$, $y_1, y_2, \ldots, y_n$ coincide with the theoretical values $X_1, X_2, \ldots, X_{2n}$. Let $\mathcal{S}(x)$ be the indices of those units actually assigned to the x treatment and $\mathcal{S}(y)$ those assigned to the y treatment. Then, *if H is true,*

$$\bar{x} = \sum_{i \in \mathcal{S}(x)} X_i / n, \qquad \bar{y} = \sum_{i \in \mathcal{S}(y)} X_i / n. \tag{7.4}$$

If the study has been randomized then $\bar{x}$ is merely the average of n randomly selected X's and $\bar{y}$ the average of the remaining n X's.

The randomization (or "permutation") test of H analogous to (7.3) is constructed as follows:

(i) Given the observed data $x_1, x_2, \ldots, x_n$, $y_1, y_2, \ldots, y_n$, define $u_1 \equiv x_1$, $u_2 \equiv x_2, \ldots, u_{n+1} \equiv y_1, \ldots, u_{2n} \equiv y_n$. (Notice that, if H is true, the u's coincide with the X's of the previous paragraph.)

(ii) For each partition $\mathcal{P} \equiv \{\mathcal{S}_1, \mathcal{S}_2\}$ of $\{1, 2, \ldots, 2n\}$ into two disjoint subsets of size n, calculate

$$(\bar{y} - \bar{x})_{\mathcal{P}} \equiv \sum_{i \in \mathcal{S}_2} u_i / n - \sum_{i \in \mathcal{S}_1} u_i / n. \tag{7.5}$$

(iii) List all $(2n!)/(n!)^2$ values of $(\bar{y} - \bar{x})_{\mathcal{P}}$ in ascending order.

(iv) Reject H in favor of A if the value of $\bar{y} - \bar{x}$ actually observed is in the upper 5% of the list.

The randomization test has a .05 chance of falsely rejecting H, *where the probability .05 now refers to an average taken over all $(2n!)/(n!)^2$ random assignments of treatment types to experimental units.* The test is still of the form "reject H in favor of A if $\bar{y} - \bar{x} > c$," except that c no longer equals the constant $2.326 \cdot \sigma / \sqrt{n}$. Instead c is a function of the set of values $\{u_1, u_2, \ldots, u_{2n}\}$ constructed in (i). For each set $\{u_1, u_2, \ldots, u_{2n}\}$, c is selected to satisfy (iv).

The randomization test has one big advantage over test (7.3). Its .05 probability of falsely rejecting H remains valid under any null hypothesis that says the $2n$ x's and y's are generated by the same probability distribution, normal or otherwise. As a matter of fact, no randomness at all in the observations need be assumed. We can just take the null hypothesis to be that each unit U_i has a fixed response X_i connected with it, no matter whether it is given the x or y treatment. This last statement reemphasizes that the randomization test must involve a non-frequentist form of averaging.

Randomization, or at least inference based on randomization, appears heretical to a Bayesian statistician. The true Bayesian must condition on the assignment $\{\mathcal{S}(x), \mathcal{S}(y)\}$ of units to treatments actually used, since this is part of the available data, and not average over all possible partitions that might have been. (Fisher's arguments on ancillarity seem to point in exactly the same direction, which is to say directly opposite to randomization!)

One aspect of randomization makes both frequentists and Bayesians uneasy. Suppose, just by bad luck, that the randomization process does happen to assign all heavy mice to the x treatment and all light mice to the y treatment. Can we still use the .05 level randomization test to reject H in favor of

A? The answer seems clearly not, but it is difficult to codify a way of avoiding such traps. To put things the other way, suppose we know the weights $w_1, w_2, w_3, \ldots, w_{2n}$ of the mice before we begin the experiment. Under reasonable frequentist assumptions there will be a unique best way $\{\mathcal{S}(x), \mathcal{S}(y)\}$ of assigning the mice to the treatments for the purpose of testing treatment x versus treatment y, one that optimally equalizes the weight assignments to the two groups. Statisticians trained in the Fisherian tradition find it difficult to accept such "optimal experimental designs" because the element of randomization has been eliminated.

8. Stein's Phenomenon. The reader may have noticed that the controversies so far have been more academic than practical. All philosophical factions agree that in the absence of prior knowledge $[\bar{x} - 2\cdot\sigma/\sqrt{n}, \bar{x} + 2\cdot\sigma/\sqrt{n}]$ is a 95% interval for μ, the disagreement being over what "95%" means. This situation changes, for the worse, when we consider the simultaneous estimation of many parameters.

Suppose then that we have several normal means $\mu_1, \mu_2, \ldots, \mu_k$ to estimate, for each one of which we observe an independent, unbiased normal estimate

$$\bar{x}_i \sim \mathcal{N}(\mu_i, 1) \quad \text{independently} \quad i = 1, 2, \ldots, k. \tag{8.1}$$

(Once again we have taken the variance σ^2/n equal to 1 for the sake of convenience.) The natural analogue of squared error loss when there are several parameters to estimate is Euclidean squared distance. To simplify notation, let $\bar{\mathbf{x}} = (\bar{x}_1, \bar{x}_2, \ldots, \bar{x}_k)$ be the vector of observed averages, $\boldsymbol{\mu} = (\mu_1, \mu_2, \ldots, \mu_k)$ the vector of true means, and $\hat{\boldsymbol{\mu}} = (\hat{\mu}_1, \hat{\mu}_2, \ldots, \hat{\mu}_k)$ the vector of estimates. Then the squared error misestimation penalty is

$$\|\hat{\boldsymbol{\mu}} - \boldsymbol{\mu}\|^2 = \sum_{i=1}^{k} (\hat{\mu}_i - \mu_i)^2. \tag{8.2}$$

Before pursuing the problem of estimating $\boldsymbol{\mu}$ on the basis of $\mathbf{x}$, we note an elementary but important fact. This fact, which can be proved in one line by readers familiar with the multivariate normal distribution, is that for every parameter vector $\boldsymbol{\mu}$ we have

$$\text{Prob}\{\|\bar{\mathbf{x}}\| > \|\boldsymbol{\mu}\|\} > .50. \tag{8.3}$$

That is, the data vector $\bar{\mathbf{x}}$ tends to be farther away from the origin than does the parameter vector $\boldsymbol{\mu}$, no matter what $\boldsymbol{\mu}$ is. Table 2 shows that for $k = 10$ the probability is actually quite a bit greater than .50 for moderate values of $\|\boldsymbol{\mu}\|$.

Suppose that $k = 10$, and we observe a data vector $\bar{\mathbf{x}}$ with squared length $\|\bar{\mathbf{x}}\|^2 = 12$. Assume also that we have no prior knowledge about $\boldsymbol{\mu}$. Looking at Table 2, it seems to be a very good bet that $\|\boldsymbol{\mu}\|^2 < 12$. For $\|\boldsymbol{\mu}\|^2$ in the range $[0, 40]$, which is almost certainly the case if $\|\mathbf{x}\|^2 = 12$, more than 75% of the time we have $\|\mathbf{x}\| > \|\boldsymbol{\mu}\|$. However, this is a frequentist "75%," calculated with $\boldsymbol{\mu}$ fixed and $\bar{\mathbf{x}}$ varying randomly according to (8.1). The analogue of the objective Bayesian argument presented in Section 4 gives quite different results.

$\|\boldsymbol{\mu}\|^2$	0	6	12	18	24	30	40	60
$\text{Prob}\{\|\bar{\mathbf{x}}\| > \|\boldsymbol{\mu}\|\}$	1.00	.967	.904	.857	.822	.795	.762	.719

TABLE 2. The probability that $\|\bar{\mathbf{x}}\| \geq \|\boldsymbol{\mu}\|$ is always greater than .5. For the case $k = 10$ the probabilities are much greater than .5 for moderate values of $\|\boldsymbol{\mu}\|$.

Given our complete prior ignorance about the parameter vector $\boldsymbol{\mu}$, it seems natural to use a flat prior of the form $\mu_i \sim \mathcal{N}(0, \infty)$ (that is, $\mu_i \sim \mathcal{N}(0, s^2)$ with $s^2 \to \infty$) independently for $i = 1, 2, \ldots, k$. This leads to the posterior distribution (4.8) for each parameter μ_i,

$$\mu_i \mid \bar{x}_i \sim \mathcal{N}(\bar{x}_i, 1) \tag{8.4}$$

independently for $i = 1, 2, \ldots, k$. This of course is a Bayesian statement, with the $\bar{x}_i$'s fixed at their observed values and the μ_i's varying randomly according to (8.4). Reversing the names of the fixed and random quantities in Table 2 gives

$$\text{Prob}\{\|\boldsymbol{\mu}\| > \|\bar{\mathbf{x}}\| \mid \|\bar{\mathbf{x}}\|^2 = 12\} = .904. \tag{8.5}$$

It now seems to be a very good bet that $\|\boldsymbol{\mu}\| > \|\mathbf{x}\|$. As a matter of fact,

$$\text{Prob}\{\|\boldsymbol{\mu}\| > \|\bar{\mathbf{x}}\| \mid \bar{\mathbf{x}}\} > .50 \tag{8.6}$$

for every observed data vector $\bar{\mathbf{x}}$! Fisher's fiducial argument of Section 5 also leads to (8.4)–(8.6).

Equations (8.3) and (8.6) show a clear contradiction between the frequentist and Bayesian points of view. Which is correct? There is a most surprising and persuasive argument in favor of the frequentist calculation (8.3). This was provided by Charles Stein in the mid 1950's and concerns the estimation of $\boldsymbol{\mu}$ on the basis of the data vector $\bar{\mathbf{x}}$ (or equivalently the estimation of the parameters $\mu_1, \mu_2, \ldots, \mu_k$ on the basis of $\bar{x}_1, \bar{x}_2, \ldots, \bar{x}_k$).

The obvious estimator is

$$\hat{\boldsymbol{\mu}}(\bar{\mathbf{x}}) = \bar{\mathbf{x}}, \tag{8.7}$$

which estimates each μ_i by $\bar{x}_i$, as at (3.1). This estimate has expected squared error loss

$$E\|\hat{\boldsymbol{\mu}} - \boldsymbol{\mu}\|^2 = k \tag{8.8}$$

for every parameter vector $\boldsymbol{\mu}$. What Stein showed is that if k, the number of means to be estimated, is $\geqq 3$, then the estimator

$$\tilde{\boldsymbol{\mu}}(\bar{\mathbf{x}}) = \left[1 - \frac{k-2}{\|\bar{\mathbf{x}}\|^2}\right]\bar{\mathbf{x}} \tag{8.9}$$

has

$$E\|\tilde{\boldsymbol{\mu}} - \boldsymbol{\mu}\|^2 < k \tag{8.10}$$

for every $\boldsymbol{\mu}$! (This particular form of $\tilde{\boldsymbol{\mu}}$ was developed jointly with W. James in 1960.) From a frequentist point of view, $\tilde{\boldsymbol{\mu}}$ estimates $\boldsymbol{\mu}$ uniformly better than does $\hat{\boldsymbol{\mu}}$. It is also better from a Bayesian point of view: given any prior distribution on $\boldsymbol{\mu}$, estimating by $\tilde{\boldsymbol{\mu}}$ rather than $\hat{\boldsymbol{\mu}}$ results in a lower overall expected squared error of estimation (averaging now over the randomness in $\boldsymbol{\mu}$ and the randomness in $\mathbf{x}$).

Stein's estimator is based on (8.3). Since $\|\hat{\boldsymbol{\mu}}\| = \|\bar{\mathbf{x}}\|$ tends to be greater than $\|\boldsymbol{\mu}\|$ with high probability, a shrinking factor $[1 - (k-2)/\|\bar{\mathbf{x}}\|^2]$ is used to give an estimate nearer $\boldsymbol{\mu}$. The shrinking factor is more drastic when $\|\bar{\mathbf{x}}\|^2$ is small. With $k = 10$, $\|\bar{\mathbf{x}}\|^2 = 12$, we have $\tilde{\boldsymbol{\mu}} = [.333]\bar{\mathbf{x}}$. If instead $\|\bar{\mathbf{x}}\|^2 = 800$ then $\tilde{\boldsymbol{\mu}} = [.99]\bar{\mathbf{x}}$. Figure 4 gives a schematic illustration.

Notice that the origin $\mathbf{O}$ plays a special role in the construction of $\tilde{\boldsymbol{\mu}}$, even though there is nothing in the statement of the estimation problem that favors $\mathbf{O}$. As a matter of fact, we can change the origin to any other point in k dimensional space, $\mathbf{O}'$ say, and obtain a different Stein estimate,

$$\tilde{\boldsymbol{\mu}}' = \mathbf{O}' + \left[1 - \frac{k-2}{\|\bar{\mathbf{x}} - \mathbf{O}'\|^2}\right](\bar{\mathbf{x}} - \mathbf{O}'), \tag{8.11}$$

which is also uniformly better than $\hat{\boldsymbol{\mu}}$.

Stein's result has created a host of difficulties for frequentists and Bayesians alike, which we can't pursue here. The implications for objective Bayesians and fiducialists have been especially disturbing. The seemingly flat prior distribution leading to (8.4) isn't flat at all: it forces the parameter vector to relatively far away from any prechosen origin $\mathbf{O}'$. If a satisfactory theory of objective Bayesian inference exists, Stein's estimator shows that it must be a great deal more subtle than previously expected.

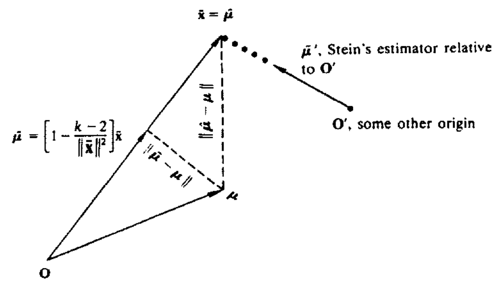

FIG. 4. Stein's estimate $\tilde{\mu}$ is obtained by shrinking the obvious estimate $\hat{\mu} = \bar{x}$ toward the origin O. The shrinking factor is more extreme the closer $\|\bar{x}\|$ lies to O. Stein and James showed that $E\|\tilde{\mu} - \mu\|^2 < E\|\hat{\mu} - \mu\|^2$ for every μ. We can choose any other origin O′ and obtain a different Stein estimate, μ', which also dominates $\hat{\mu}$.

The trouble with the multiparameter estimation problem is not that it is harder than estimating a single parameter. It is easier, in the sense that dealing with many problems simultaneously can give extra information not otherwise available. The trouble lies in finding and using the extra information. Consider the Bayesian model (4.1). With just a single μ to estimate this model must be taken on pure faith (or relevant experience). However, if we have several means to estimate, $\mu_1, \mu_2, \ldots, \mu_k$, each drawn independently from an $\mathcal{N}(m, s^2)$ population, the data $\bar{x}_1, \bar{x}_2, \ldots, \bar{x}_k$ allows us to *estimate* m and s^2, instead of postulating their values. Plugging the estimated values into (4.6) gives an "empirical Bayes rule" very much like the Stein rule (8.11). Empirical Bayes theory, originally developed by Herbert Robbins in the early 1950's, offers some hope of a partial reconciliation between frequentists and Bayesians.

9. Some last comments. The field of statistics continues to flourish despite, and partly because of, its foundational controversies. Literally millions of statistical analyses have been performed in the past 50 years, certainly enough to make it abundantly clear that common statistical methods give trustworthy answers when used carefully. In my own consulting work I am constantly reminded of the power of the standard methods to dissect and explain formidable data sets from diverse scientific disciplines. In a way this is the most important belief of all, cutting across the frequentist-Bayesians divisions: that there do exist more or less universal techniques for extracting information from noisy data, adaptable to almost every field of inquiry. In other words, statisticians believe that statistics exists as a discipline in its own right, even if they can't agree on its exact nature.

What does the future hold? At a recent conference Dennis Lindley, of University College, London, gave a talk entitled, "The future of statistics—A Bayesian 21st century." My personal subjective probability is .15 on that eventuality. The big advantage of subjective Bayesianism, which is what Professor Lindley was referring to, is its logical consistency. Philosophers who investigate the foundations of scientific inference usually wind up being repelled by frequentism and attracted to the Bayesian argument.

But consistency isn't enough. Subjective Bayesianism must face the challenge of scientific objectivity. This is the ultimate stronghold of the frequentist viewpoint. If the 21st century is Bayesian, my guess is that it will be some combination of subjective, objective, and empirical Bayesian, not significantly less complicated and contradictory than the present situation. The complexity of the problems statisticians are asked to deal with is increasing at an alarming rate. It is not unusual these days to deal with data sets of a million numbers, and models with several thousand parameters. As Section 8 suggests, this trend is likely to exacerbate the difficulties of producing a logically consistent theory of statistics.

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AN EXPERIENCE RATING FORMULA (REPRINT)

Ralph Keffer

An Experience Rating Formula
by
Ralph Keffer

This short paper, published in 1929, is reprinted, by permission, from the *Transactions of the Actuarial Society of America*, which was the predecessor of the Society of Actuaries. It is the earliest known application of the gamma-Poisson mixture to experience rating, and seems remarkably modern. Note also three references to PCAS papers, which suggests there was a fair degree of interaction between life and casualty actuaries of that era.

An Experience Rating Formula

BY

RALPH KEFFER.

Mr. Albert W. Whitney has developed a formula for experience rating which is described in a paper appearing in Volume IV of the Proceedings of the Casualty Actuarial Society. This formula was developed from the standpoint of Workmen's Compensation Insurance, but it has been adapted to other lines, in particular to Group Insurance.*

Mr. Whitney assumed that, for any given class of risks, the average class hazard resulted from different individual risk hazards. In order to develop a formula he assumed that these individual risk hazards were distributed about the mean class hazard in accordance with a known frequency curve. For the purpose of his paper he assumed that the normal frequency curve would apply. Then, on the assumption of this frequency distribution of the real risk hazard, the problem which he set was to develop a formula for the most probable rate which, when applied to a particular individual risk, would make possible the actual experience which was observed. The formula developed on this assumption did not appear to be workable from a practical standpoint and therefore various substitutions and approximations have been suggested for the term z which appears in the formula

$$x = P + z\,(p - P)$$

but the form which seemed to be preferred was

$$z = \frac{Pn}{Pn + K}$$

where Pn is the total premium for the risk and K is a constant to be determined by judgment and inspection.

In the consideration of some questions relating to Group Insurance my attention was called to a certain formula which proved to be Mr. Whitney's formula in a little different form. This led to the investigation of the assumptions underlying the formula

* See, for example, remarks by Mr. Bassford, P.C.A.S., Vol. VIII, p. 307.

with particular reference to the meaning of the constant in the formula. A development of this formula is given below, starting from certain original assumptions which differ somewhat from those made by Mr. Whitney. The formula has been considered with particular reference to its application to Group Insurance although it would apply in certain other lines of insurance.

The following are the initial assumptions:

(1) Assume the existence of an average scale of net rates of mortality which when applied to all groups or to all groups of a certain classification will give the real expected number of deaths for the combined groups.

(2) Assume the existence of a true scale of rates of mortality for any individual group such that the variations in actual experience from year to year from this true rate are in accordance with the laws of probability.

(3) Assume this true scale of rates for each individual group may be obtained by multiplying the rates for each age of the average scale by a constant.

(4) Assume the average scale of rates for all groups combined does not change during the period under observation.

(5) Assume the true scale of rates for an individual group does not change during the period of observation.

(6) Assume the ratios of the true scale of rates for each group to the average scale for all groups combined are distributed about the mean in accordance with the following frequency distribution:*

$$y = Ce^{-kr}(kr)^m \qquad (1)$$

where r is the ratio of the true rate to the average rate and C, k, and m are constants to be determined.

This frequency distribution appears more natural to use than the normal since $y = o$ for $r = o$ and y has a finite value for

* This is a special form of Pearson's Type III frequency curve. See Elderton "Frequency Curves and Correlation." The equation there is in the form

$$y = y_0 e^{-\gamma x}\left(1+\frac{x}{a}\right)^{\gamma a}$$

but it may be changed to the form of equation (1) by taking $\gamma = 1$ and making the substitutions $a = m$ and $a + x = kr$ after which $C = \frac{y_0 e^m}{m^m}$.

every value of r greater than zero. The ratio of the true scale of rates to the average scale must be greater than zero, but there is not necessarily an upper limit to its value.

The following considerations determine the values of C and k. If the equation is to be expressed in a form such that

$\int_{r_1}^{r_2} y\,dr$ will give the probability that r lies between r_1 and r_2

then the constant C must be determined so that $\int_0^\infty y\,dr = 1$.

But $\int_0^\infty C\,e^{-kr}\,(kr)^m\,dr = \frac{C}{k}\,m!$*

$$\therefore C = \frac{k}{m!}\,.$$

By definition the mean value of r is 1. But the mean value of r is given by

$$\frac{\int_0^\infty r\,y\,dr}{\int_0^\infty y\,dr} = \int_0^\infty \frac{kr\,e^{-kr}\,(kr)^m}{m!}\,dr$$

$$= \frac{m+1}{k}\int_0^\infty \frac{e^{-kr}\,(kr)^{m+1}}{(m+1)!}\,d\,(kr)$$

$$= \frac{m+1}{k}$$

$$\therefore k = m+1.$$

The equation of the frequency curve is reduced to the form

$$y = \frac{(m+1)\,e^{-(m+1)r}\,[(m+1)r]^m}{m!} \qquad (2)$$

which contains the as yet undetermined constant m.

To see the effect of the constant m in equation (2) it may be simpler to make the substitution

$$x = (m+1)r$$

after which equation (2) reduces to the form

$$y = \frac{(m+1)\,e^{-x}\,x^m}{m!}\,. \qquad (3)$$

* This integral is a form of the Gamma function

$$\Gamma(n+1) = \int_0^\infty e^{-x}\,x^n\,dx = n! \text{ for integral values of } n.$$

The constant m determines the shape of the curve and hence depends on the assumptions regarding the distribution of all possible true rates of mortality. A large value of m means that they are assumed to be closely grouped about the mean, i.e., that the *a priori* probability that the true rate is near the average rate is very high.

The graphs of equation (2) for values of $m = 14$, 29, 44 and 89, show the effect of different values of m.

The total area under each curve is unity and the area under any curve between any two limits is equal to the assumed *a priori* probability that the true rate applicable to a group about which nothing is known, will lie between those limits.

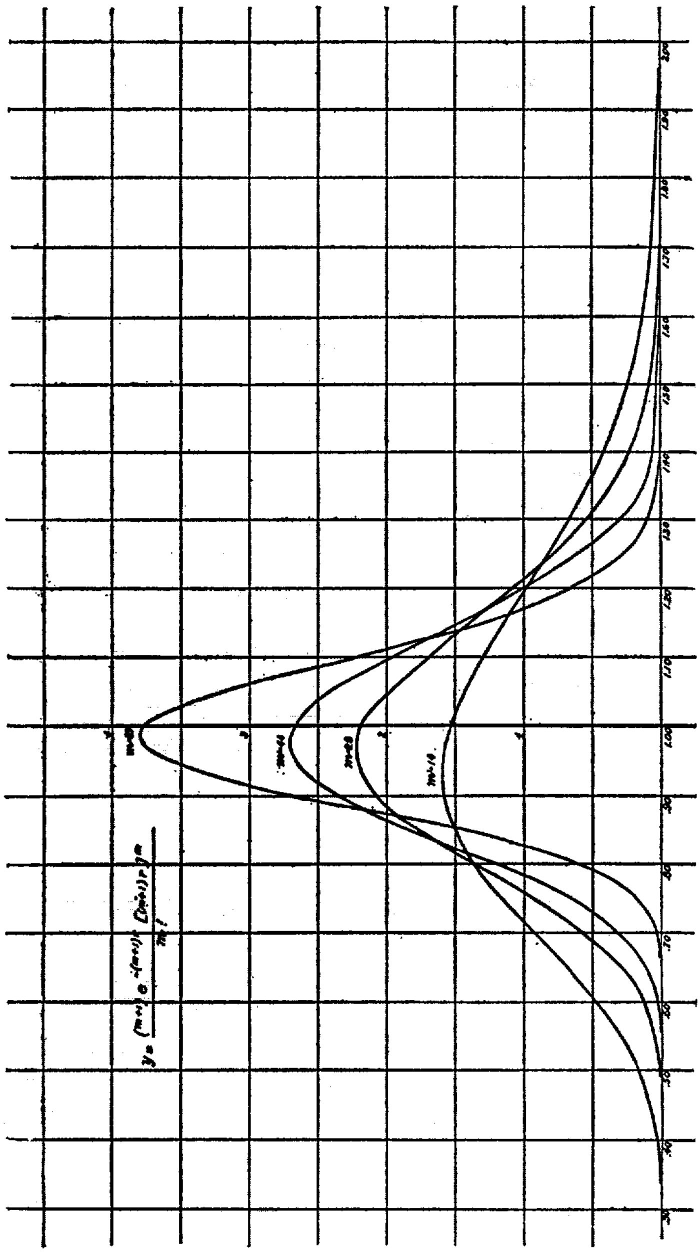
The following table summarizes the values of these probabilities:

ASSUMED DISTRIBUTION OF TRUE RATES OF MORTALITY.

Ratio of True Rate to Average Rate	Percentage of total groups which may be expected to fall in each class			
	$m = 14$	$m = 29$	$m = 44$	$m = 89$
30% to 40%	.1%			
40% to 50%	.9%			
50% to 60%	3.1%	.5%	.1%	
60% to 70%	6.9%	3.1%	1.3%	.1%
70% to 80%	11.6%	9.6%	6.9%	2.3%
80% to 90%	14.9%	17.6%	18.2%	14.9%
90% to 100%	15.9%	21.9%	26.4%	34.7%
100% to 110%	14.4%	19.9%	23.7%	31.0%
110% to 120%	11.5%	13.7%	14.9%	13.5%
120% to 130%	8.3%	7.9%	6.3%	3.2%
130% to 140%	5.4%	3.7%	1.5%	.3%
140% to 150%	3.4%	1.5%	.5%	
150% to 160%	1.9%	.5%	.2%	
160% to 170%	1.0%	.1%		
170% to 180%	.5%			
180% to 190%	.2%			

The use of $m = 89$ implies that the true rates of mortality will be practically confined between the limits of 70% and 130% of the average rate with 94% of the cases between 80% and 120% while the use of $m = 14$ implies a wider spread from 40% to 180% of the average rate with only 57% of the cases between 80% and 120%. At the present time there does not seem to be any way to fix a value of m except to estimate the probable range by judgment.

In each case the mean value of r is at the point $r = 1$, but the



mean value is not the most probable value as may be seen from the curves or as may be determined analytically by setting the first derivative of y equal to zero. This shows the most probable value to be at the point

$$x = m$$

$$\text{or } r = \frac{m}{m+1}.$$

Moreover, the probability that r is less than 1 is greater than the probability that r is greater than 1, which means that if the true rate could be determined for each group a larger number of groups would be entitled to reductions below the average rate than would require increases. This is to be expected because of two groups of the same size, the one with the greater number of expected deaths will contribute more to the average experience. For any given group r is equal to the ratio of the expected deaths at the true rate to the expected at the average rate.

Let d be the actual number of deaths in a given group over a period of time for which the expected number at the average rate is c.

Then rc is the expected number of deaths at the true rate.

Since the probability of death is small, we may assume that Poisson's formula* holds for the probability that a given number of deaths will occur, therefore the probability that d deaths will result when the true expected is rc is

$$\frac{e^{-rc}\,(rc)^d}{d\,!}.$$

But from our assumed frequency distribution the probability that the true r lies between r and $r + dr$ is

$$\frac{(m+1)\, e^{-(m+1)r}\, [(m+1)r]^m}{m\,!}\, dr.$$

Therefore, the probability that the true rate r lies between r and $r + dr$ and that the application of this rate r to a given group in which the expected number of deaths at the average rate is c,

---

* Sometimes known as the Bortkewitsch "Law of Small Numbers." See description of Table LI in Pearson's Tables for Statisticians and Biometricians or Fisher, Mathematical Theory of Probabilities, 2nd Edition, p. 265, etc.

will result in d deaths is the product of the above two expressions, which may be put into the following form

$$\frac{(m+1)^{m+1} c^d (m+d)!}{(m+1+c)^{m+d} m!\, d!} \cdot \frac{e^{-(m+1+c)r} [(m+1+c)r]^{m+d}}{(m+d)!} dr.$$

Hence the distribution of the values of r which will result in d actual deaths in groups for which the expected at average rate is c, is given by the curve

$$y = K \frac{e^{-(m+1+c)r} [(m+1+c)r]^{m+d}}{(m+d)!} \tag{4}$$

where K is the constant multiplier which appears in the previous expression.

By an analysis similar to that used for equation (1), the mean value of $(m+1+c)r$ is found to be at the point

$$(m+1+c)r = m+d+1$$

hence the mean value of the ratio of the true rate to the average rate for a group where the actual number of deaths is d and the expected at average rate is c is

$$r = \frac{m+1+d}{m+1+c}. \tag{5}$$

In order to compare with Mr. Whitney's formula this may be written as

$$r = 1 + \frac{c}{c+m+1}\left(\frac{d}{c} - 1\right). \tag{6}$$

By differentiating the expression in equation (4) we find that the most probable value of the ratio of the true rate to the average rate for a group where the actual number of deaths is d and the expected at the average rate is c, is

$$r = \frac{m+d}{m+1+c}.$$

But the most probable value is not necessarily very probable and for insurance purposes the mean is the more logical function to use. In this particular case there is little difference between the mean and the most probable unless small values of m are assumed.

The c in formula (5) is the expected number of deaths at the average rate applicable to all groups or to all groups of a certain class. The total group experience of six companies has been compiled each year and ratios of actual to expected by the

American Men Ultimate Table have been published.* This experience is large enough to give accurate results not only for the total experience but for certain subdivisions.

This experience is easily converted into loss ratios in terms of the Standard Gross Premium Rate prescribed by the State of New York. The formula used to compute this scale of rates is

$$P_{\overset{1}{x}\,\overline{1|}} = \frac{(1.035)^{-1}\, q_x + .0017}{.935}$$

where q_x is by the $AM^{(5)}$ table.

The total premium is then

$$\Sigma\, P_{\overset{1}{x}\,\overline{1|}} = \frac{(1.035)^{-1}\, \Sigma\, q_x + .0017\, S}{.935}$$

where S is the total amount of insurance exposed and $\Sigma\, q_x$ is the total expected mortality by the $AM^{(5)}$ table, both of which values are given in the tabulations of the group experience.

The ratio of actual claims to total premiums will give the loss ratio at standard rates. Let this average loss ratio for all groups combined be λ. Then, instead of r in formula (5) we shall want to find $\lambda\, r$ to determine the portion of the premium at standard rates that we shall require for payment of claims. The c in formula (5) may be expressed in terms of loss ratios at standard rates and the formula transformed in several ways for ease of computation.

Formula (5) is expressed in terms of number of deaths and this is essential to its theoretical development. For practical purposes it may be expressed in terms of amounts of insurance on the assumption that the experience will be the same as if each life were insured for the average amount. The formula on this basis may be written as follows

$$r = \frac{(m+1)\, A + D}{(m+1)\, A + C} \qquad (7)$$

where A is the average amount of insurance in force upon each life in the group and D and C are respectively the actual and expected losses by amounts. If a death loss occurs for an amount in excess of the average, formula (7) would then give

* T. A. S. A., Vol. XXVI, p. 332, also privately published annual reports by E. E. Cammack, Chairman of the Committee on Group Mortality Investigations.

a higher value of r than if formula (5) were applied. Since abnormal losses are more likely to be in excess of the average than otherwise, this modification of the formula would, in general, be on the safe side.

In the practical use of formula (5) or (7) allowance must be made for incurred and unreported claims. This may be done by making a deduction from c or C or by deferring the application of the formula to a given experience until all claims are likely to be reported.

It must be kept clearly in mind that formula (5) does not necessarily give an approximation to the true rate for any given group. The ultimate experience for any given group may be found to be different from either the average rate for all groups or the first rate given by the use of the formula. However, as the experience increases and c and d become large in comparison with m the formula gives a rate which is nearer the indicated rate. From the probability theory we know that the indicated rate will approach the true rate as experience increases so that for large enough groups the formula should give a satisfactory approximation to the true rate.

What the formula does is to give a reclassification of the groups by size and experience. It determines a new average rate for each new class such that for a large enough business the premium income should, in the aggregate, be the same as if the uniform average rate were charged each group. If we have two groups of the same size with the same number of deaths in the past, the true mortality rate of one may be quite different from the true mortality rate of the other; nevertheless, in the absence of other information bearing on the risk it seems proper that the same premium rate should be made applicable to each. From this point of view formula (5) may be said to determine the best rate of mortality to apply to a given group, subject of course, to the original assumptions of this paper being applicable to the group business.

The question of experience rating for group insurance must be considered by two types of companies. On the one hand there is the non-participating company which expects to charge a uniform average rate for all groups the first policy year, but expects to adjust future rates on the basis of experience. For such companies the formula offers a satisfactory method of determining future rates. If a uniform rate is charged the first year which produces a total premium just sufficient to pay claims and overhead, then upon renewal it will be necessary to make increases for some groups if reductions are made for others.

On the other hand a company which issues participating group policies expects to charge each year a premium which will be greater than required and then expects to adjust the net cost by dividends at the end of the year. Formula (5) may be used by such companies to determine the portion of the premium paid by each group which should be applied to mortality, for the formula applies just as well to past experience as to future. Logically it seems to be the proper basis of a method of distributing dividends, for it determines the rate that would have been charged at the beginning of the year if there had then been available the knowledge regarding the risk which developed during the year. But practical questions enter into its adaptation to distribution of dividends unless the premium rate charged contains a sufficient margin to cover the mortality of the most unfavorable group. The question of negative dividends brought about when the participating premium is insufficient has been considered in a paper by Mr. William Leslie* to which reference should be made. As pointed out there and in the discussion by Mr. Bassford, retroactive increases in premium are usually uncollectable and so if the original gross premium is not sufficient to cover the adverse mortality in certain risks, the deficit must be made up elsewhere. All dividends may be reduced or a maximum dividend rate may be adopted in which case the groups with good experience will not receive the full dividends to which they would otherwise be entitled or an increase in future rates may be counted upon to make up past deficits as well as to provide an adequate rate for the future.

The practical application of any experience rating formula or dividend distribution formula must, of course, take account of expenses, but this paper has been limited to a consideration of the mortality factor alone.

* P. C. A. S., Vol. VIII, pp. 70-71. See also discussion, pp. 308-309.

RATEMAKING 1989

Nolan Asch

INTRODUCTION

Before he went on to even greater thespian heights, Dave Skurnick was bound and gagged in Dallas in March, 1989 at the CAS Ratemaking Seminar! In light of the positive reaction of the audience at the time and the timelessness and interest of the theme, I thought it worthwhile to publish this play manuscript belatedly in the Actuarial Forum. There are serious issues forwarded inside the context of the humor. Also, it is a belated way of honoring the cast who put a lot of time and effort into this production.

Nolan Asch

NARRATOR

This year we will be presenting a brief play entitled "Ratemaking 1989." I will act as your narrator. The cast is the "NOT READY FOR A STABLE MARKET PLAYERS." Please remember that the companies are totally fictitious and any resemblance to any actual firm is totally coincidental.

Pricing decisions are often driven by many non-technical factors; not least among them is "The State of the Market." Each firm has a perception of itself and a corporate culture, corporate situation, and corporate strategy it, consciously or unconsciously, brings to all its actions.

ACT I

GLOBAL GALACTIC

CAST

Nolan Asch. . . . . CHAIRMAN

Jerome Tuttle. . . . . PLANNER

Dave Skurnick. . . . . NARRATOR

4/26

ACT I

GLOBAL GALACTIC

PLANNER: ...As you can clearly see -- the trend in pricing for all lines is clear via our monthly monitoring systems.

(SHOW CHART)

Price Levels
See Chart 1

(Slide 1-1)

June 1984 June 1986

The decline continues ... although at a less severe slope this month ...

CHAIRMAN: I know all this -- what I must know is where the break-even profit position for these rates is -- I am the chairman and the final strategic decision must be mine.

PLANNER: Break-even levels are, as you know, a result of many factors -- the payment pattern and loss ratio outcomes, investment returns --

CHAIR: Yes, I know all this. It's clear the June 1984 rates were ruinously low and the trend had to change. In 1986, rates peaked out at high profit margins, and rates have plummeted ever since. --- My actuary keeps telling me about claims cost inflation, "shock" awards, the next "pollution fiasco" -- while my marketing VP keeps telling me about the market share and anti-selection. But what I want to know is ...

PLANNER: Yes - I know - you want to know which strategy will have the better impact on long-term Earning Per Share.

CHAIR: And Short-term EPS.

PLANNER: Well, here I can maintain a simple position. Given our large casualty distribution of business, the easiest way to improve short term earnings is--

CHAIR: I know - maximize current premium volume. The losses cannot appear immediately, but the premiums do. Let's look at those premium numbers again.

PLANNER: (SLIDE 1-2)

As you know, premiums exploded from 1985 thru mid-1987, due to price increase. As you can see, (SHOW CHART) our commitment to high standards led to flat premiums through 1988 and signs of premium shrinkage in 1989.

However, our actuarial analysis shows clearly, that on the "1985 standards basis," the percentage of premiums written to that standard has dropped consistently -- from 1985 - 100%.

To 1987 - Jan. 90% Dec. 70% (SLIDE 1-3)

1988 - July 50% Dec. 25%

In other words - only.

CHAIR: Yes, I know --

PLANNER: Don't interrupt!

CHAIR: Damn those actuaries, their logic is irrefutable. They're like my conscience! So... the only certain way to achieve the desired EPS increase is to increase premiums - by writing more business whose rates, terms and conditions today are marginal and appear to be still deteriorating.

PLANNER: We don't have to kow-tow to Wall Street. We're a Top Ten firm in this industry and we have credibility with most on Wall Street.

CHAIR: It's not just Wall Street I'm worried about ... It's our parent company. The cereal people.

PLANNER: I thought they said ...

CHAIR: Yes -- I have their total confidence. Since they bought us in 1984, I showed them nothing but massive earnings increases in 1985 and 1986. In 1987, they saw that EPS was increasing, but at a much slower rate. In 1988, they didn't like flat earnings, with several "down" quarters, AT ALL. Now, I'm afraid, if 1989 isn't up they'll be eating me for breakfast. They don't totally understand all the technical nuances of this business -- like we do. I'm afraid if EPS doesn't move up, I'll be replaced. Aside from ego and selfish motives, replacing me with a less responsible or less competent CEO will be bad for the whole industry ... and the public. What should I do?

ACT II

COWBOY CASUALTY

CAST

Nolan Asch. . . . . CHAIRMAN

Jerome Tuttle . . . . PLANNER & STAFF MAN

Cecily Gallagher. . . . . . . STAFF MAN 2

ACT II

CAFETERIA OF COWBOY CASUALTY

(THE CHAIRMAN IS HOLDING ONE OF HIS "KITCHEN CABINETS" WITH SEVERAL KEY EXECUTIVES)

CHAIR: You know ... we have a motto here at Cowboy Casualty -- "No one has a job here unless somebody out there makes a sale." It's taken us from a medium-sized regional insurer to a major national insurance company in less than 5 years. We have had a compound premium growth rate of over 30% a year throughout the period.
(SHOW SLIDE 2-1)

STAFF: But to continue that growth rate we'd need to become a $450 Million company in 1992.
(SHOW SLIDE 2-2)

CHAIR: Why not? It's just perpetuating the same growth rate of the last 4 years.

STAFF: Because, sooner or later there are limits to our size. We can't write almost every risk. And by continuing to cut rates we are helping to reduce the total Industry Premium pie every year.

CHAIR: I know you worry about our recent rate reductions -- but let's look at the "big picture" (SHOW SLIDE 1-1 AGAIN ON IND RATES) Even though rates are declining. They are still well above 1983/84 rate levels. ... Also, you forget our 3 secret weapons ...

STAFF: I know

CHAIR: But do you really believe? We have a saying here at Cowboy Casualty ...

STAFF: I know ... "Knowledge without belief is a barren tree."

CHAIR: Well -- Let's review our 3 weapons:
#1 - you no longer need underwriting profits to realize a profit on business. Our investment department has consistently earned returns 2 to 3 points better than the industry.

STAFF: Only over 5 years, after investing in riskier instruments than our competitors.

CHAIR: But you agree we've been earning 10% annum. Our average payout is 3 years after premium collection. That means we can break even at a 133% combined ratio. (SLIDE 2-3)

STAFF: If the 10% holds up. Also, you're ignoring the new tax law and the fact that at 20% commission you only earn interest on 80%, and you are <u>not always</u> going to earn investment income faster than loss payments materialize. (SLIDE 2-4)

CHAIR: Your 80% point is well taken ... (SLIDE 2-5) But we still break even at 1.0648 - .80 = .267 + 1 = 126.48%. Also, our new plan is write even longer-tail business to increase our investment leverage.

Our second weapon is our superior portfolio. We have had a clientele of smaller, loyal risks in rural locales. Their frequency characteristics have always been superior to industry averages. And we avoid anti-selection by being the lowest priced market in each of our target sectors.

STAFF: This weapon is eroding. We're now a national company with a slightly less select book and our target sectors now cover 50% of our premium volume ... not 10% as when we started the program. Also our rate is eroding.

CHAIR: How are we going to lose money on people who never file claims? My claims-free discount system has been praised by many industry experts.

STAFF: Giving a 5% discount on renewal to a claims-free risk the first year is fine, even for a 2nd or 3rd year -- but extending it up to 10 years for a maximal 50% discount!!! It didn't matter in the early years when no one had earned many discounts -- but we're now in year 4 and 90% of those policyholders have earned a 20% discount.

CHAIR: That's great! We've kept them loss free <u>and</u> <u>with</u> <u>us</u> for 4 years! 90% claims-free!!! Just imagine if 10% or 20% more had left us?! We'd have lost all that clean premium! These people are going to think twice about leaving us, or filing any small claims to forfeit their claims free discount!

STAFF MAN 2: Mr. Chairman - we've got a large risk new business submission that needs your immediate attention.

CHAIR: YA HOO - There's nothing like new business.

STAFF MAN 2: It's a fairly large firm. The key to the risk is their products liability for automobile parts. (SHOW CHART) As you can see -- with loss development, their rate per exposure has been climbing slowly. (SLIDE 2-6)
With current trends, it seems next year's ultimate net loss cost should be $322,000 grossed up for 25% Expenses by 100/75ths; (SLIDE 2-7) that's a $430,000 Premium. That's probably not enough since their latest loss control report from their existing carrier has caused them to quote a renewal rate higher than this designed to lose the renewal.

CHAIR: Maybe -- Maybe not. Also, what's the policy limit and policy aggregate? Let's see, with a 5-year average payout at 10% ... that's a 161% combined to break-even. So -- we don't need $430,000. We need 430/1.61 = $286,000. (SLIDE 2-8)

STAFF MAN 2: It's a $1M occurrence policy with a $2M general policy aggregate but the LAE is in addition to limits. (SLIDE 2-9) The 5-year average indication is $326,000 not $430,000 but the risk manager is looking for a premium of around $150,000. Last year, they paid $250,000 and Mindless Mutual is competing also.

CHAIR: (TO STAFF 1) We haven't yet factored in our 3rd and strongest secret weapon ... (PAUSE)

STAFF 1: What's that?

CHAIR: RICKETTY RE

If memory serves me well, we have a 750 xs 250 treaty with Ricketty Re and a 1M xs 1M treaty. We pay a rate of 10% for both covers combined. Aggregate excess is included for products. That means we are writing a policy with a $250,000 Net Aggregate loss-limit and 5-year average pay-out lag.

STAFF 1: But -- I've told you how shaky Ricketty Re is getting. Also, we know we'll suffer that full 250K loss for certain -- and the payout pattern for us will be far shorter than 5 years, since we're paying the first losses -- our reinsurer will be paying the later losses. We can't just assume 10% interest rates.

CHAIR: Hmm - This sounds like a tough one -- well -- Let's call our actuary in on this one. Go get him.

(ACTUARY IS WHEELED OUT -- BOUND AND GAGGED)

(CHAIR SPEAKS WHILE STAFF UNTIES ACTUARY)

Let's summarize -- let him look at all the data on this risk -- then give him 3 minutes to speak.

As I see it, it's a golden opportunity. This is precisely the kind of longer tail business we now want to write. With our reinsurance arrangements at a $150,000 Premium and a 10% treaty cost ... (that's what the risk manager wanted) That's $135,000 left and 1.61 for investment income, that's $217,000 to pay a maximum loss of $250,000. That's good odds to me. (SLIDE 2-10)

ACTUARY: This is nonsense! You need to subtract at least 25% for commissions, taxes and expenses up front! Even using all your assumptions that generates (217) x (.75) Not 217. (SLIDE 2.11) The 250 is expected to be paid every year. Also, there is generally 40 cents of LAE for every dollar of loss - (SLIDE 2.7, again) so expect 322 x .40 = $129,000 of LAE per annum to fund. That yields an ultimate loss and LAE of $451,000 per annum to pay for. Our payout pattern is going to be shorter than 5 years! Most importantly -- my security review of Ricketty Re finds them very Ricketty indeed.

CHAIR: That's enough. I'm beginning not to like you -- Boy. Ricketty Re is solid! Highly regarded by all the rating agencies.

ACTUARY: They're growing too fast in relation to their surplus! They're at 2.5 to 1! Their loss reserving is consistently testing inadequate.

CHAIR: Hell! That's what everybody's whispering about us -- Growing too fast!! Overleveraged! We've got positive cash flow up our ying-yang!!! See you later!

(ACTUARY IS REBOUND AND REGAGGED)

CHAIR: (ALONE) That actuary is a smart guy. Stands up to me. I like that. Got to think about that angle. Still -- these technicians just somehow cannot grasp the BIG PICTURE.

END

ACT III

MINDLESS MUTUAL

CAST

Nolan Asch . . . . CHAIRMAN

David Skurnick . . . . ACTUARY

Jerome Tuttle. . . . . SAM SALES

Cecily Gallagher . . . . NEW PLAYER

ACT III

MINDLESS MUTUAL

CHAIRMAN: Well, I can see here that premiums are not meeting our growth plans.

ACTUARY: I told you that accepting the sales department's proposal of a 20% rate decrease would generate less premium rather than more ----.

CHAIRMAN: But they guaranteed us a 50% increase in policies in-force at those rates to create 20% premium growth.

ACTUARY: And once again they failed us all -- And -- the analysis shows us that they only wrote more business in the "preferred category" -- where rates are down 40%, and less business than ever in the one-third of the former portfolio with no rate change. So the original plan was as follows:

CHART 1 (SLIDE 3-1)

	TERRTY 1	TERRTY 2	TERRTY 3	AVERAGE
Old Weight	1/3	1/3	1/3	
Rate Change	-40% (.60)	-20% (.80)	0% (1.00)	-20% (.80)
Planned PIF	1.5	1.5	1.5	1.5
Planned New Weight	1/3	1/3	1/3	
Premium Volume Change				+20.0%

WHAT WE GOT LAST YEAR WAS THIS

CHART 2 (SLIDE 3-2)

	TERRTY 1	TERRTY 2	TERRTY 3	AVERAGE
Old Weight	1/3	1/3	1/3	
Rate Change	-40% (.60)	-20% (.80)	0% (1.00)	-20% (.80)
Act. PIF Change	+20%	+0%	-20%	
Premium Volume Change				-23%

A 23.2% PREMIUM DECREASE WITH SAME POLICY COUNT
AND EXPOSURE LEVEL

SAM SALES: Hello everyone

OTHERS: Hello Sam!!!

SAM SALES: Still trying to brainwash our chairman against the "tried and true" techniques that this firm has used for 30 years.

ACTUARY: And should have stopped using 30 years ago ---

SAM: When Charlie's dad founded this firm 70 years ago -- its intent was to supply low cost and reliable insurance to people no one else would insure. We're not a greedy stock firm -- a prisoner of Wall Street's expectations. We are not in existence for greed and profit. We represent a way of life.

ACTUARY: Yes -- we all know --
THE MINDLESS WAY

SAM: Well -- I know the 23% premium drop was a disappointment to us all. Our sales reps worked like mad last year -- but -- as I told you last year -- even with that measely ~~mealy~~ 20% rate decrease, our rates are still not competitive. Our high rate levels cause only the poorer risks to stay with us and the good ones to leave -- perpetuating poor loss ratios that justify more rate increases that drive away more "good" business.

ACTUARY: This is ridiculous! We took a rate decrease -- not a rate increase. Not competitive!!! With whom?!

SAM: I'm glad you asked -- Look at these figures -- You can see we're never the lowest rated. Podunk Mutual is beating our brains out in most places --

SLIDE 3-3 PREMIUM COMPARISON

	TER'TY 1	TER'TY 2	TER'TY 3	AVG
Podunk Mutual	100	80	80	96
Global Galactic	80	110	80	104
Cowboy Casualty	60	60	60	60
Mindless Mtl - Before	100	100	100	100
Mindless Mtl - After	60	80	100	80
Actuarially Indicated	100	100	100	100
Weight	1/3	1/3	1/3	
Policy Count Change	+20%	0	-20%	(100)

22/26

ACTUARY: We've been through all this -- These three firms; Podunk Mutual, Global and Cowboy, only represent 20% of the market. Our tables always use the 5 largest firms in the market for comparison. Global Galactic has 80% of their portfolio in Territory 2 so their average rate is (110) (.80) + (.2) = 88 + 16 = 104. (SLIDE 3-4) Podunk Mutual writes 80% in Territory 1 -- so they come to (100) (.8) + (.2) (80) = 96. (SLIDE 3-5)

SAM: What about Cowboy Casualty? They're the "hot market," -- They're big and getting bigger fast! They beat us everywhere. Also -- rumor has it that even Global Galactic is about to get more competitive. Their field offices get so many mixed signals from their Home Office -- everyone's dizzy.

ACTUARY: Cowboy Casualty will be bankrupt within 5 years --

SAM: Says you -- They're A-rated and surplus goes up every year --

ACTUARY: Yeah -- much faster than their absurdly understated loss reserves!

SAM: So emotional! By the way, Charlie -- How's the golf game?

CHAIR: Fine -- We really need to get together soon. You know I love to play with you.

ACTUARY: Let's get back to business.

CHAIR: Must we?! It's a lovely day.

ACTUARY: Look at the situation we've put ourselves in! Our average rate is only 80 now! Our premium is dropping! Our loss ratios are booming!

CHAIR: You know -- you really should take up golf. You're far too emotional and serious about all this. We've gotten by for 70 years without all this advanced Actuarial analysis. It was my idea -- over Sam's objections, to start Actuarial 5 years ago. How are you going to get us the sales we need?

ACTUARY: What! Sam's the sales VP, not me! I've already bent over backwards to accommodate him.

NEW PLAYER: (TIMIDLY) Excuse me -- I though it important to show you a new business proposition just in from Fearless Freddie.

SAM: See -- Sales once again can save the day.

(SAM READS THE NEW BUSINESS PROPOSAL)

We're up against Cowboy Casualty on this one -- It will be tough. However, we've had the property insurance on this account for 20 years! It has had a 30% loss ratio at $100,000 per year. That's 2 Million in Premium with a profit of (30% +30% Exp = 60%) $800,000. If Cowboy gets the Casualty the Property will be next. We need to defend this core account.

ACTUARY: Don't get emotional! Why don't you go to your normal office at the golf course.

SAM: It can be done! We can quote $100,000 and use our Property profits on the risk to make it profitable on a joint basis.

(EVERYONE LEAVES BUT THE CEO)

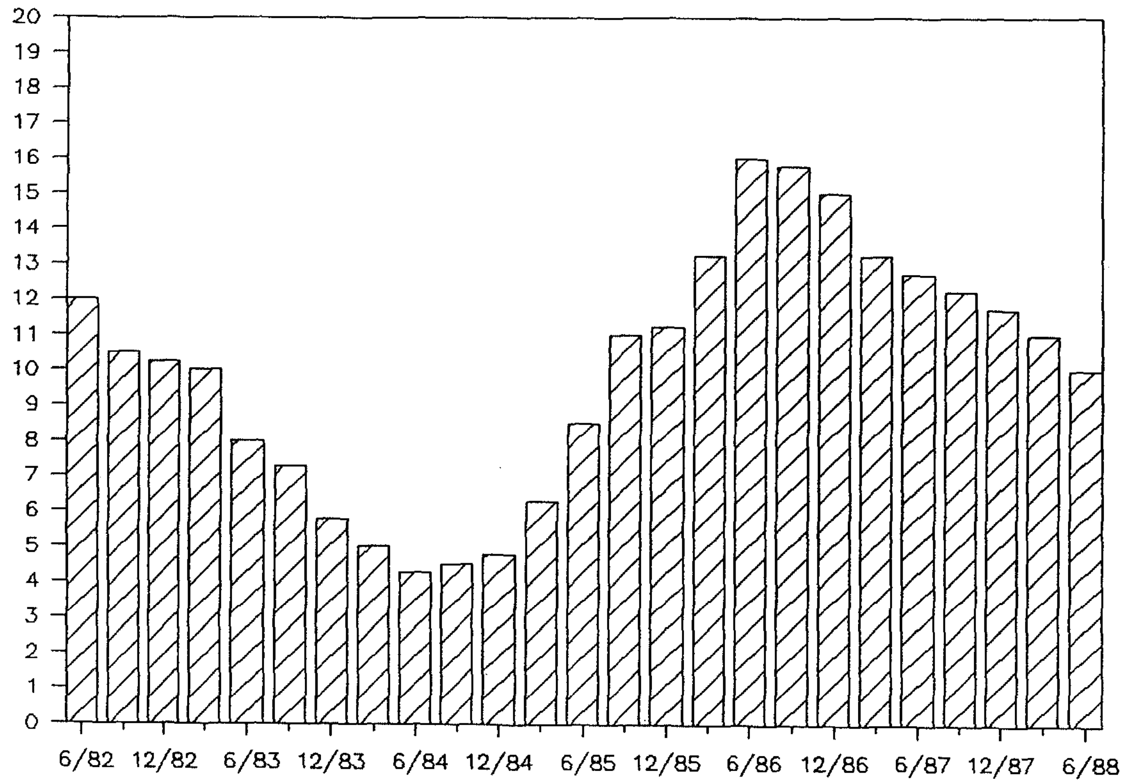
CEO: What should I do? Sam has been with the firm forever. The Actuaries appear to be so smart, with all their logic and numbers. I'm going to have to make a policy decision, sooner or later. The status quo or this new "scientific" Actuarial approach to pricing?

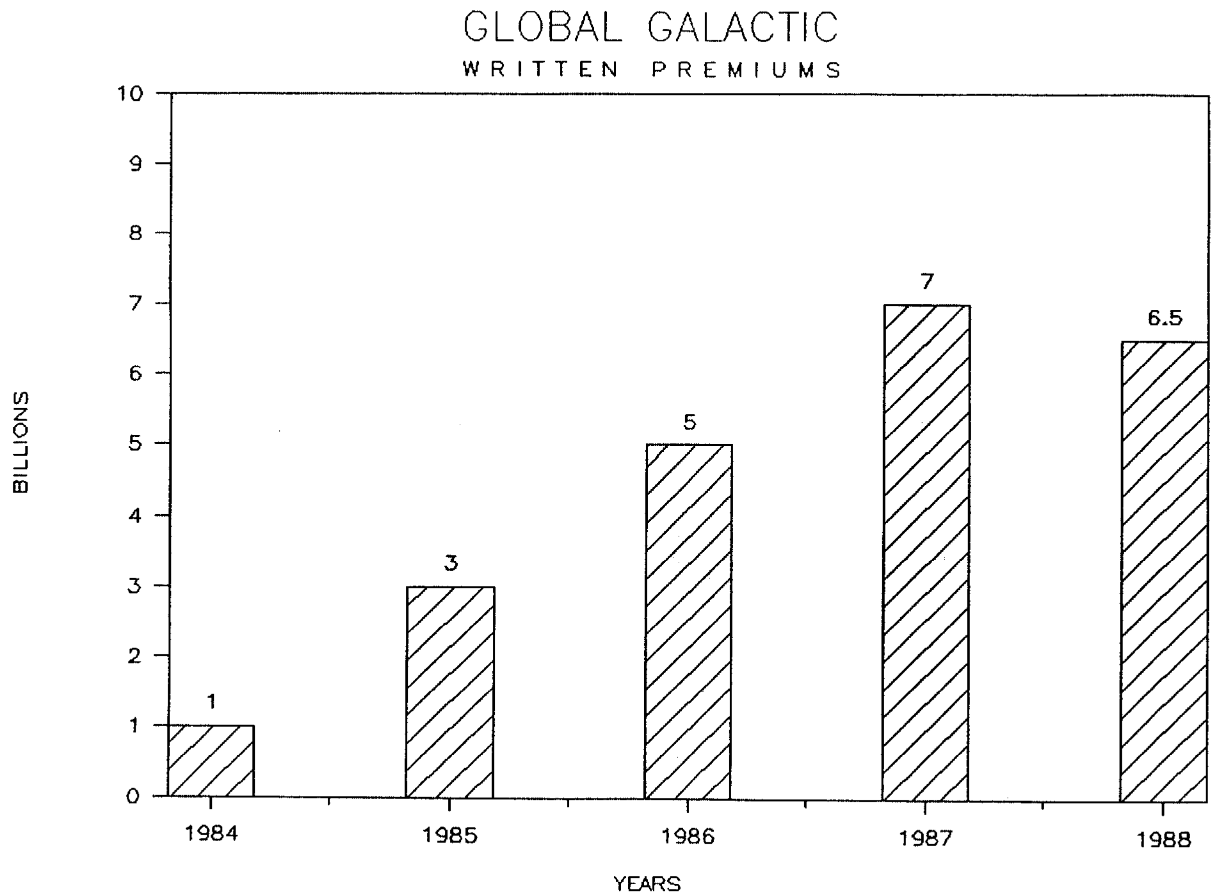
NARRATOR: What decisions did the 3 CEOs make in 1989? We'll leave that to your imagination and judgment. We wanted to make a non-technical presentation at the start to make several things clear ...

1. These issues are of paramount importance to any firm.
2. They are complex.
3. They should <u>not</u> be left to habit, "gut feel," subjective analysis or prejudice. You will spend the rest of this seminar listening to technical and educational sessions. We hope this has provided some spice to the diet for both our technical and non-technical audiences.

SLIDE 1 - 1

PRICE LEVELS




GLOBAL GALACTIC
WRITTEN PREMIUMS
BILLIONS
YEARS
0
1
2
3
4
5
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1984
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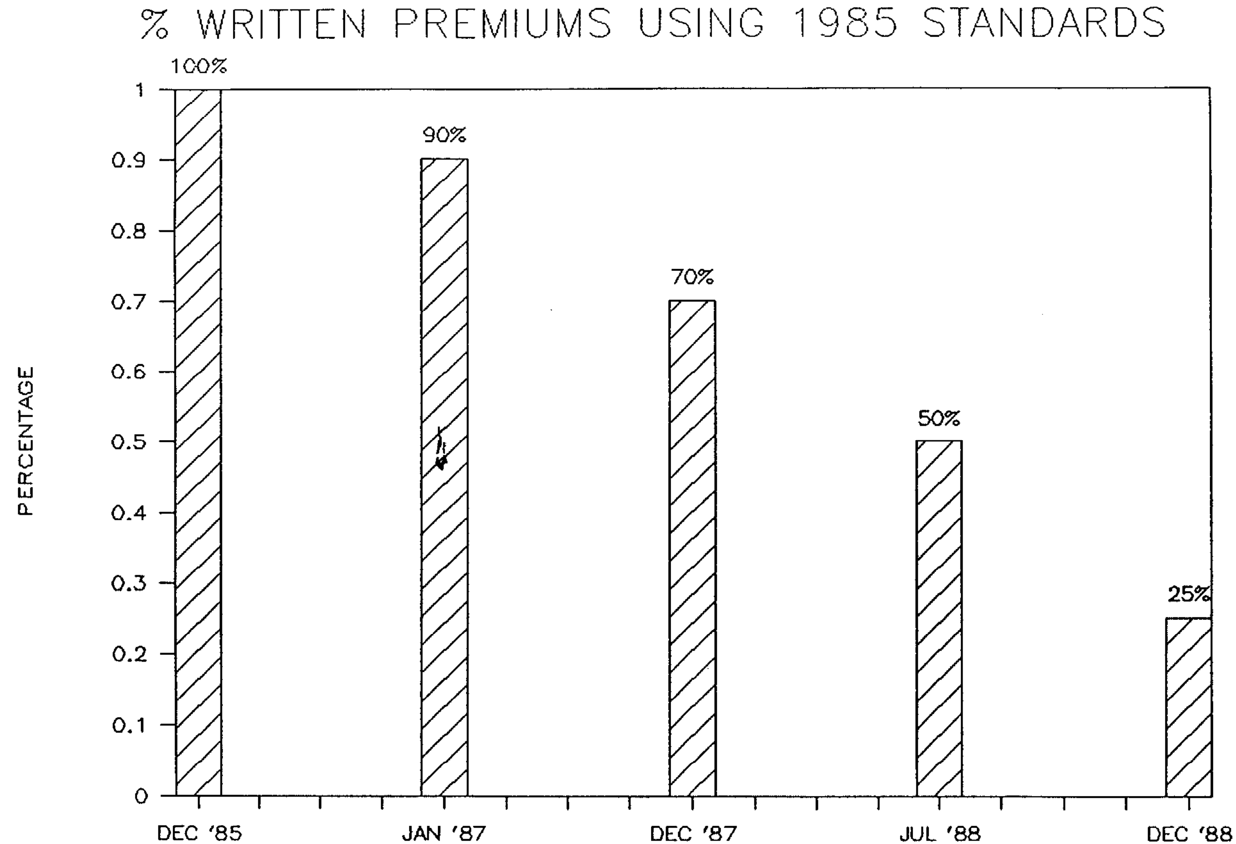
7
6.5

slide 1 - 2

317


% WRITTEN PREMIUMS USING 1985 STANDARDS
100%
90%
70%
50%
25%
PERCENTAGE
1
0.9
0.8
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0.6
0.5
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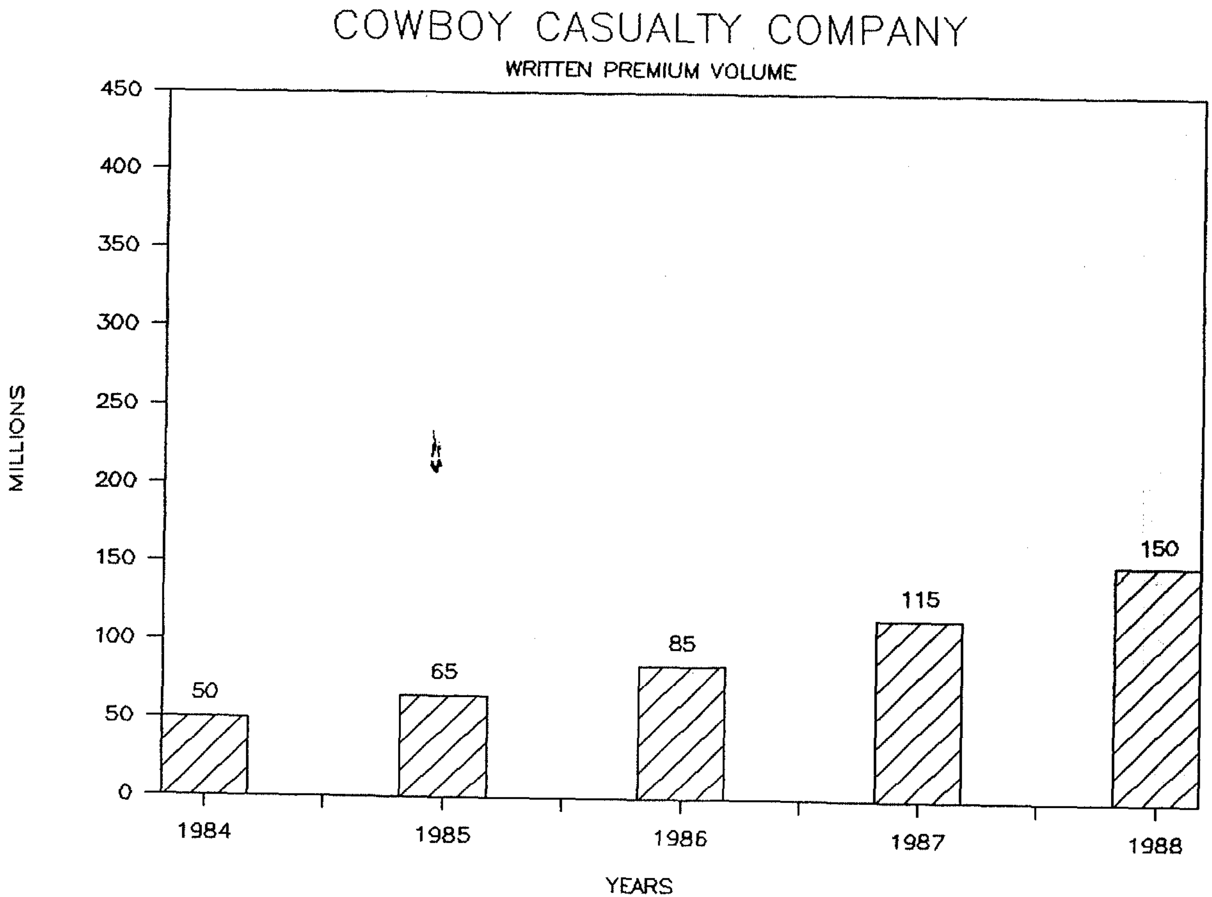
DEC '85
JAN '87
DEC '87
JUL '88
DEC '88

slide 1 - 3


COWBOY CASUALTY COMPANY
WRITTEN PREMIUM VOLUME
MILLIONS
450
400
350
300
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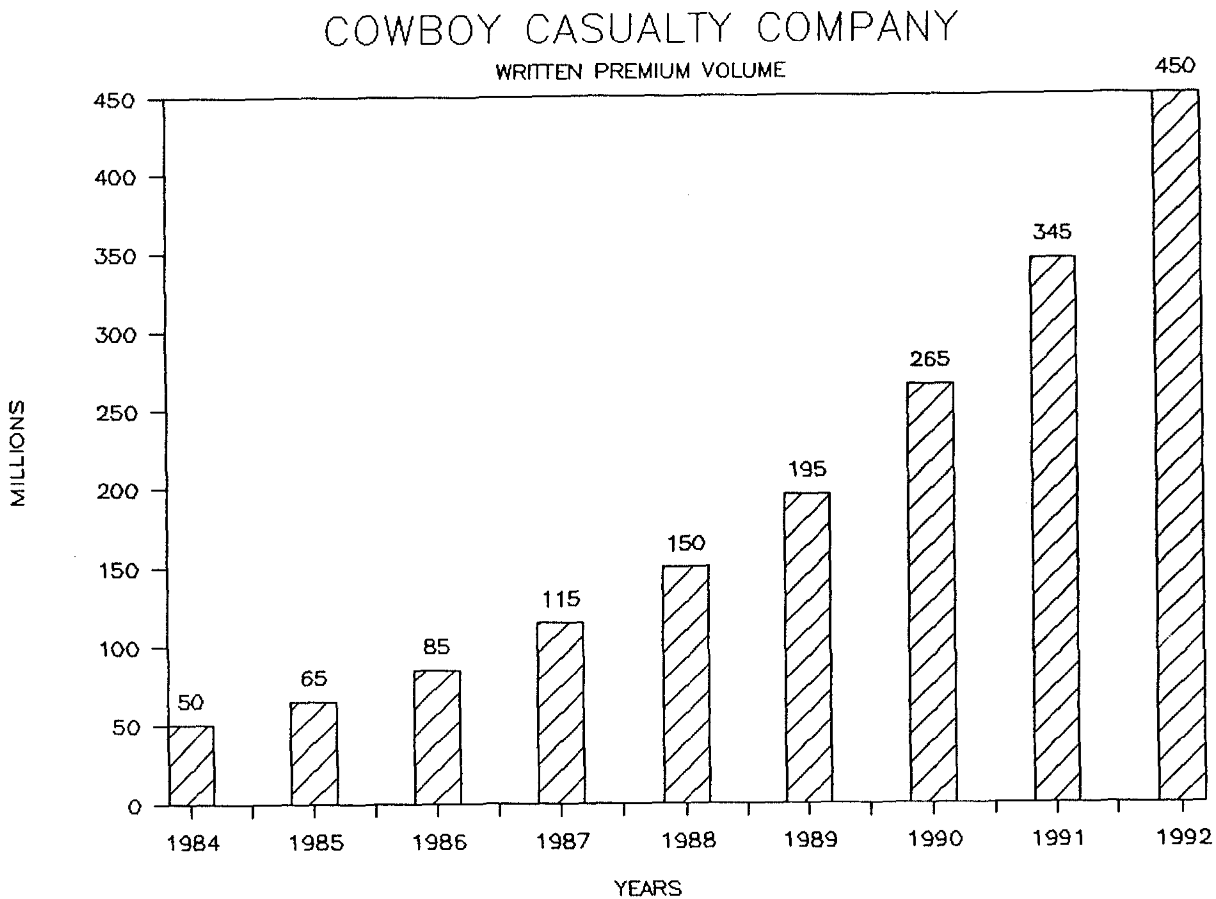
1984
1985
1986
1987
1988
YEARS

slide 2 - 1

slide 2 - 2


COWBOY CASUALTY COMPANY
WRITTEN PREMIUM VOLUME
MILLIONS
0
50
100
150
200
250
300
350
400
450
50
65
85
115
150
195
265
345
450
1984
1985
1986
1987
1988
1989
1990
1991
1992
YEARS

320

slide 2 - 3

$$(1.1)^3 = 1.331$$

slide 2 - 4

$$(.8)(1.1)^3 = 1.0648$$

slide 2 - 5

$$1.0648 - .80 = 0.2648 + 1$$

$$= 126.48\ \%$$

slide 2 - 6

S U B M I S S I O N

XYZ AUTO PARTS

YEAR	EXPOSURES	ULTIMATE LOSS COSTS	ULTIMATE COST PER EXPOSURE	ESTIMATED AVERAGE PAYOUT
1982	1,000	200	200	3.0 YEARS
1983	1,000	220	220	3.5 YEARS
1984	1,000	242	242	4.0 YEARS
1985	1,000	266	266	4.0 YEARS
1986	1,000	293	293	4.5 YEARS
5 YEAR AVERAGE		244		

S U B M I S S I O N

XYZ AUTO PARTS

YEAR	EXPOSURES	ULTIMATE LOSS COSTS	ULTIMATE COST PER EXPOSURE	ESTIMATED AVERAGE PAYOUT
1982	1,000	200	200	3.0 YEARS
1983	1,000	220	220	3.5 YEARS
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1985	1,000	266	266	4.0 YEARS
1986	1,000	293	293	4.5 YEARS

EXPECTED '87
VIA TREND ANALYSIS ========= > 322

$ 3 2 2 , 0 0 0 x (1 0 0 / 75 ths) = $ 4 3 0 , 0 0 0

S U B M I S S I O N

XYZ AUTO PARTS

slide 2 - 9

YEAR	EXPOSURES	ULTIMATE LOSS COSTS	ULTIMATE COST PER EXPOSURE	ESTIMATED AVERAGE PAYOUT
1982	1,000	200	200	3.0 YEARS
1983	1,000	220	220	3.5 YEARS
1984	1,000	242	242	4.0 YEARS
1985	1,000	266	266	4.0 YEARS
1986	1,000	293	293	4.5 YEARS

EXPECTED '87 LOSSES
VIA TREND ANALYSIS ==========> 322

$ 3 2 2 , 0 0 0 x (1 0 0 / 75 ths) = $ 4 3 0 , 0 0 0

$$(1.1)^5 = 1.61051$$

$$\frac{\$430,000}{1.61051} = \underline{\underline{\$286,000}}.$$

slide 2 - 9

S U B M I S S I O N

XYZ AUTO PARTS

YEAR	EXPOSURES	ULTIMATE LOSS COSTS	ULTIMATE COST PER EXPOSURE	ESTIMATED AVERAGE PAYOUT
1982	1,000	200	200	3.0 YEARS
1983	1,000	220	220	3.5 YEARS
1984	1,000	242	242	4.0 YEARS
1985	1,000	266	266	4.0 YEARS
1986	1,000	293	293	4.5 YEARS
5 YEAR AVERAGE	========== >	244		

$ 2 4 4 , 0 0 0 x (1 0 0 / 75 ths) = $ 3 2 6 , 0 0 0

R I C K E T T Y   R E

WRITTEN PREMIUM		$150,000
TREATY COST		10%
NET INVESTABLE FUNDS		$135,000
5 YR COMPOUNDED INTEREST INCOME		1.61
CUMULATIVE FUND AFTER 5 YEARS	=	$217,000

slide [illegible] - 11

R I C K E T T Y R E

A C T U A R I A L A N A L Y S I S

COMMISSIONS, TAXES & EXPENSES	25%
ADJUSTED CUMULATIVE FUND AFTER 5 YRS	\$217,000 (.75) = \$163,000
EXPECTED ULTIMATE LOSSES	\$322,000
EXPECTED LAE PER ANNUM	40%
EXPECTED LAE AMOUNT PER ANNUM	\$129,000
TOTAL EXPECTED LOSSES	\$451,000

M I N D L E S S   M U T U A L

C H A R T   1

	TREATY 1	TREATY 2	TREATY 3	AVERAGE
OLD WEIGHT	1/3	1/3	1/3	
RATE CHANGE	-40% (.60)	-20% (.80)	0% (1.00)	-20% (.80)
PLANNED PIF CHANGE	1.5	1.5	1.5	1.5
PLANNED NEW WEIGHT	1/3	1/3	1/3	

P R E M I U M   V O L U M E   C H A N G E   = = = = = >   + 2 0 . 0 %

slide 3 -2

M I N D L E S S   M U T U A L

C H A R T   2

	TREATY 1	TREATY 2	TREATY 3	AVERAGE
OLD WEIGHT	1/3	1/3	1/3	
RATE CHANGE	-40% (.60)	-20% (.80)	0% (1.00)	-20% (.80)
ACTUAL PIF CHANGE	+20%	+ 0%	-20%	

P R E M I U M   V O L U M E   C H A N G E   = = = = = = >   - 2 3 %

P R E M I U M   C O M P A R I S O N

	TERR 1	TERR 2	TERR 3	AVERAGE
PODUNK MUTUAL	100	80	80	96
GLOBAL GALACTIC	80	110	80	104
COWBOY CASUALTY	60	60	60	60
MINDLESS MUTUAL - BEFORE RATE CHANGE	100	100	100	100
MINDLESS MUTUAL - AFTER RATE CHANGE	60	80	100	80
ACTUARIALLY INDICATED	100	100	100	100
WEIGHT	1/3	1/3	1/3	1/3
PIF CHANGE	+20%	0%	-20%	-110%

slide 3 - 3

INTRODUCTION TO GENERAL INSURANCE STUDY

Charles A. Hachemeister

GENERAL INSURANCE STUDY GROUP
WORKING PARTY PAPERS

In Great Britain, the Institute of Actuaries and the Faculty of Actuaries have a joint committee on general insurance, chaired by Terry Clarke. A sub-committee, chaired by Peter Johnson, is responsible for organizing the two-day annual conventions of the General Insurance Study Group.

Each of these conventions is devoted largely to the discussion of papers prepared by working parties established following the previous year's convention. These papers are not refereed and are therefore not to be treated as authoritative statements on the issues being discussed.

However, the resulting papers provide valuable insights into many issues which are of interest to both British general insurance actuaries and CAS members. With this in mind, we have obtained permission from Peter Johnson to publish the following sampling of working papers which were discussed at the General Insurance Convention in October 1990:

Latent Claims

Mortgage Related Insurance

Reinsurance to Close at Lloyd's

Reinsurance & Retentions - Vol. I & Vol. II

Charles A. Hachemeister
Chairman
International Relations Committee

STATEMENT REGARDING THE LATENT CLAIMS PAPER

"The report represents the first attempt by the actuarial profession to understand the issues involved in many types of latent claims, and it should not be taken as an authoritative statement of fact on these issues. Indeed, one important reason for its publication is to set out our present understanding so that it can be corrected by those with first hand knowledge of the problems. Therefore, any comments, whether to correct matters of fact, or of critical observation, will be most welcome and should be made to any member of the Working party, whose names appear in Appendix 1. The report has been referred to one of the EGG attorneys and his detailed comments have been incorporated. However, we accept responsibility for any errors which remain.

LATENT CLAIMS (GISG CONVENTION, 10/90)

Latent Claims Working Party

LATENT CLAIMS

Report of the Latent Claims Working Party
presented to the GISG Convention
at Newquay, October 1990

LATENT CLAIMS WP REPORT

CONTENTS

APPENDICES

LATENT CLAIMS

1. Introduction

This report is largely a survey of the background to the main types of latent claims currently being faced by UK insurers, reinsurers and syndicates, together with some suggested approaches to reserving for such claims. We also conducted a survey of reserving practices, which is included. Although the report is long, each section is largely self-contained, and it should be possible to read only those sections of interest without loss of understanding. We include a detailed contents section to aid reference.

The Working Party members are still learning about many of the issues covered by the paper, and inevitably there will be some factual errors. The report should therefore be seen as part of the process of getting at the truth, rather than as a definitive statement of the current position. We hope that the review of the paper by actuaries and others will identify and correct these errors.

The situation of some types of latent claim is very fluid, and even if the report were accurate now, it would soon be overtaken by events. We have tried, therefore, simply to identify and explain the issues which need to be considered. We have not attempted to establish the present position nor to comment on the merits of the arguments. All statements in this report represent the personal views or understandings of the members of the working party, and are in no way representative of any of the organisations for which these individuals work.

We believe this subject is of interest and potential concern to most insurers. At one extreme, UK direct writing insurers are likely to have some exposure to industrial disease claims for EL business, giving rise to difficulty in establishing a suitable reserve, and in justifying the figure to the Inland Revenue. These reserving problems will exacerbate the current problems of pricing and may delay the required recovery in EL rating. At the other extreme, London Market Reinsurers who write (or wrote) US Casualty business, are facing Asbestos and Pollution claims whose ultimate cost is most uncertain, but potentially very large.

Nor are UK direct insurers necessarily immune from the US problems:

a) Some UK insurers have US subsidiaries who may have such exposures.

b) Some write reinsurance or retrocession business and may be exposed by that route.

c) Most buy reinsurance and would be adversely affected by large-scale reinsurance failure.

d) The US was not unique in using asbestos or burying dangerous chemicals in holes in the ground. The Americans may have a somewhat gung-ho approach to financing the solutions but they are not the only ones with problems.

The report inevitably has a strong American accent as the most worrying and extensive latent claims emanate from across the Atlantic. Anyone coming fresh to a study of US insurance problems should be wary of relying on their UK experience. In particular:

Policy wordings and conditions are different.

The law is different (from that in the UK, and indeed from State to State),

Legal procedures are different,

The language is different (for example some US Courts have held that "sudden" does not necessarily mean "happening quickly".)

US law, in particular, has extensive discovery provisions, and any documents not protected by attorney-client privilege may have to be disclosed in the event of litigation. Attorney-client privilege applies only to documents or discussions between a lawyer and his client, expressly for the purpose of giving or receiving legal advice. That privilege may be deemed to have been waived if the document is disclosed to a third party. Consulting actuaries may, therefore, find they are denied access to documents which may contain important information. They should also be aware that if they are shown these documents, that may prejudice their privileged status. It may be necessary for the actuary to put himself in an attorney-client position with the attorney whose work he needs to read.

Liability claims are frequently subject to dispute and litigation, although these normally relate to the underlying claim and not the issue of coverage under the policy. Actuarial techniques, however, operate with collective data, and do not require the actuary to form opinions about the likely outcome of individual cases. In pollution and asbestos property claims, however, we have whole classes of claims which are subject to coverage disputes and litigation of substantially similar substance, and the required reserves depend on the outcome of this litigation. This takes the problem into an area where actuaries have no specific training or experience. It also inhibits open discussion, as it is hardly proper to discuss in public the likely outcome of current litigation.

2. SURVEY OF DEVELOPMENT AND RESERVING PRACTICES

A survey of developments and reserving practices in the non-life insurance industry, in respect of latent claims, was distributed to 276 insurers in the market, including composites, specialist general insurers and reinsurers, London Market companies and Lloyd's Managing Agents. By the middle of August 1990, 67 responses had been received, of which 50 indicated significant exposure to latent claims. The results, based on responses received as at that date, are summarised in Appendix X.

The main points to note from the results of this survey, as detailed in Appendix X, are as follows:-

As would be expected, Pollution and Asbestos latent claims are causing the most concern in the market. This is highlighted by the degree of sophistication of reserving for such claims in that separate development data tend to be held and specific IBNR reserves are established.

Latent claims have generally emerged over the last 15 years although the exposure to such claims goes back prior to 1950.

Initial notifications for product-related latent claims appear to be concentrated in a ten year period whereas initial industrial disease latent claim notifications appear to be spread over a wider period.

The input of Attorneys into the reserving process is significant.

The major methods of calculating IBNR reserves are:-

(a) analysis of claim amounts and reporting patterns, and
(b) analysis of exposures.

Respondents were also asked if they would be prepared to provide further information, including details of actual claim developments. Of the responses received to 20th August 1990, 38 have confirmed that they would be willing to do so.

3. THE NATURE OF LATENT CLAIMS

3.1 Towards a Working Definition

The topic we were originally given was "Latent Disease". However, the problems presented to insurers by latency are much the same, whether or not the cause of the claim is a disease. We therefore extended the scope and the title of the project to "Latent Claims", which allowed us to include pollution and asbestos property claims.

The well known examples of latent claims are all new types of claim which were not anticipated when the contracts were written, have taken a long time to emerge and were already pending in large numbers when the first reports started to come in. They are also associated with problems that take a long time to develop and are caused by gradual processes.

The question is, which of these characteristics are fundamental to the concept of latent claims, and which are simply consequences of those characteristics. We took the view that what matters to the insurer is the long delay and the fact that the claims were not anticipated. The fact that latent claims normally result from processes rather than from sudden events is thus regarded as coincidental. Also, this view means that in future, when the current backlog of old deafness claims has been cleared, we will refer to the then current deafness claims as simply long tail and not "latent". In the meantime we offer the following working definition:

"Any identifiable category of claims where the cost-weighted mean delay between inception of the policy and notification of the claim exceeds 5 years and which was not anticipated when the business was written. If more than one policy contributes to the cost of a claim, then all contributing policies are included in the calculation."

3.2 Causes of Latent Claims

In the context of insurance, latency does not follow precisely the meaning which would be attributed to the word in a clinical sense. The "latent period" between inception of the policy and notification of the claim can arise from a number of factors, or even a combination of factors. There is genuine clinical latency in the case of industrial diseases where there is a long interval between exposure to the hazard and the emergence of symptoms giving rise to the claim. Mesothelioma is one such example where the manifestation of disease can be a considerable period after the last exposure to asbestos dust. There is a parallel in claims arising from liability for pollution risks where, for example, there may be a long delay between the dumping of waste and the manifestation of consequences.

The development of the underlying cause of the claim may be continuous and progressive as a result of the cumulative effects of exposure over time. Many of the respiratory industrial diseases fall into this category. The delay in reporting the claim is not due to the strict clinical latency of the disease, in that its progress would have been capable of measurement and recognition at a much earlier stage. Here the latent effect arises because a claim is reported only when the symptoms of disease have surpassed a certain threshold.

There are some forms of industrial disease, notably deafness, where the extent of the damage remains undetected whilst the individual is young enough to be able to compensate for the deterioration in health or hearing. It is often only when the toll of industrial disease is combined with the natural effects of ageing that the employee becomes sufficiently aware of his condition to lodge a claim. This may be many years after the first exposure to the hazard.

The length of the reporting tail may be influenced by the level of awareness of the extent to which the working environment, or the effects of a specific product, have contributed to the underlying cause of the claim. In the description which follows, concerning the claims arising from Dalkon Shield, it will be seen that claim development patterns change with increasing public awareness of the link between the use of the product and the pathological problems which it induced.

Finally, claims on old policies may be precipitated by legislation which has a retro-active effect, as in the case of US pollution and UK deafness claims.

3.3 Examples of Latent Claims

This section contains brief background notes on the main types of currently outstanding latent claims.

a) Agent Orange

Agent Orange is a chemical defoliant which was widely used by the US Army in the Vietnam War to eliminate enemy hiding places. In 1979 an American war veteran sued several major chemical companies, alleging health problems arising from exposure to Agent Orange and other defoliants. In 1983 this suit was expanded into a class action and in 1984 the claimants and the chemical companies reached a settlement. The chemical companies agreed to pay $180M into a settlement fund without admitting liability or even that there was any relationship between the defoliants and the alleged symptoms.

It is estimated that between 1961 and 1972 approximately 3.5 million servicemen served in or near to the combat area and during that period an estimated 20 million gallons of chemical defoliant were used.

Under the compensation structure established by the court, the fund was to be divided into three parts:

1) approximately 2% for non-US service personnel,
2) approximately 23% to establish and fund support organisations to help veterans and their dependants
3) the remainder for specific compensation to disabled US veterans and the surviving dependants of deceased veterans.

b) Dalkon Shield

The Dalkon Shield was an intra-uterine contraceptive device of a new style and design that was produced and marketed vigorously by A H Robins from the late 1960's into the 1970's, initially in the US and then worldwide.

The device caused almost immediate problems in some women, but in most the effects were delayed. From about 1975 it became apparent that the use of the device was leading to major problems in a very substantial numbers of cases. Within a few years, TV programmes were warning users about the risks involved, and once public awareness was raised, claims began to flood in. Sales of the device ceased in about 1980 but by that stage a very large number of women had been fitted with the device and were continuing to use it.

A H Robins was insured with Aetna, who bought reinsurance, both in the US and in the London Market, subject to a fairly substantial retention.

The number of claims has escalated to the point where all insurance cover (and reinsurance cover) has become a total loss and A H Robins has faced claims amounting to four or five times the total insurance cover which it bought. The resulting financial difficulties led to a bankruptcy petition in 1985. A claim cut-off date of 30th April 1986 was established by the Federal District Court Judge who is handling the bankruptcy proceedings. The cut-off date precluded the filing of new claims after that point so that, having reached a peak in 1985, the numbers of new filings fell dramatically thereafter.

The graph of reinsurance claim development patterns attached to the end of this report shows how public awareness can cause claims to flood in after an initial delay.

c) DES

DES (diethylstilboestrol) is a synthetic oestrogen, which was developed in the UK in 1938 as a cheaper and more convenient alternative to natural oestrogen. It was approved in 1941 by the US Food and Drink Administration (FDA) for use in the treatment of menopausal symptoms, postpartum breast engorgement and some forms of vaginitis. It was later used in the treatment of breast and prostate cancers and, in 1947, was approved for use in preventing miscarriages.

In 1971, a link was suggested between *in utero* exposure to DES and certain gynaecological abnormalities in female offspring, such as adenosis and vaginal inflammation. It has also been alleged that such exposure may cause adenocarcinoma in female offspring and various genito-urinary abnormalities in male offspring. Following these allegations, the FDA prohibited the use of DES in pregnant women, although it is still manufactured today for other uses.

It is estimated that over 4 million women have taken DES during pregnancy, and it is known that about 300 companies were involved in the manufacture or distribution of the drug. Claims are now being made against almost 150 defendants, including Abbott Laboratories, Eli Lilly and Company, E.R. Squibb & Sons Inc. and The Upjohn Company.

These claims now span 3 generations:

a) The first generation (ie. those who took DES directly) usually allege breast or gynaecological cancers.

b) The second generation (ie. those whose mothers took DES during pregnancy) usually allege gynaecological or genito-urinary abnormalities or cancers, as described above.

c) The third generation (ie. the grandsons and granddaughters of women who took DES during pregnancy) usually allege that problems such as blindness, cerebral palsy and various forms of retardation may have been caused by allegedly DES-induced abnormalities in their mothers.

Clearly, if a third generation effect can be established, the duration of the liability and the size of the IBNR problem will be greatly increased. This issue is currently subject to considerable litigation, and the outcome remains uncertain. There may, however, ultimately be many thousands of claims.

d) Lung Diseases (other than Asbestos Related)

i) Pneumoconiosis amongst mine workers is perhaps the earliest example of latent claims, with notifications going back to the 1950s.

The most common and severe of all pneumoconioses is silicosis which is a fibrosis of the lung caused by breathing dust containing silica. Silica is found in a variety of forms, the most common and most important being quartz. Exposure to silicosis can arise in a wide variety of occupations, from underground mining and tunnelling in quartz bearing rock, to the stripping and relining of furnaces and to the manufacture of pottery and porcelain.

The level of risk depends upon three factors:

- the concentration of dust in the atmosphere
- the concentration of free silica in the dust
- the duration of exposure.

The incidence of pneumoconiosis has diminished significantly in the past 20 years as a result of improved systems of dust suppressions and ventilation. In the UK, the number of newly compensated cases of all forms of pneumoconiosis in coalmines was as follows:

Year	Number
1960	3,300
1965	1,000
1970	800
1975	600

ii) Byssinosis is a chronic respiratory disorder which affects cotton, flax and hemp workers. The condition gives rise to tightness of the chest and breathlessness which is often particularly marked on the first day back at work after a weekend break. After continued exposure to dust, the worker may be severely disabled with symptoms of chronic bronchitis and emphysema.

Epidemiological studies in flax, soft hemp and cotton factories show that at least 40% of workers exposed to dusty conditions are affected to some extent. Paradoxically, more modern processes have exacerbated the problem. Mechanical picking has increased the contamination of cotton with debris from the plant itself, whilst the speeding up of the processes have increased dust concentration. Among hemp workers, the problems arise in the processing of soft hemp which is a fibre from the stem of the plant. There does not appear to be a danger of byssinosis associated with processes involving leaf fibres.

The gradual changeover to the use of synthetic fibres should reduce the risk of occupational respiratory disease since synthetic fibres are not thought to give rise to byssinosis. Nevertheless the disease may still be increasing in developing countries.

e) Myodil

Myodil is a dye which was used for producing X-ray scans in cases of back trouble, known as myelography. It was produced by Glaxo Laboratories and used from the early 1940s. Initially, it was hailed as a significant advance over previously-used substances, all of which had produced unacceptable, toxic side effects. Many thousands of investigations were carried out and the use of the drug undoubtedly improved the accuracy of diagnosis in such cases as sciatica, brachalgia, paraplegia and quadriplegia.

However, a relatively small proportion of patients in whom it was used proved to be peculiarly sensitive to Myodil and some present day symptoms are claimed to have resulted from its use more than a decade ago. The drug was withdrawn from use in 1987. The solicitors currently dealing with the claims have been quoted as saying that the totality of claims could exceed 150M. More modern methods of diagnosis (such as magnetic resonance scans) may well be useful in distinguishing between true or false claims.

f) Occupational Deafness

Occupational deafness, or noise induced hearing loss, is probably the most widespread occupational disease in the UK. Government estimates indicate that at least 2 million employees in the UK have been exposed to excessive noise for a significant period during their employment and that approximately 1 million employees in the UK manufacturing industry have noise induced hearing loss. Exposure to noise induced hearing loss can arise in a wide variety of occupations but is particularly prevalent in heavy industry such as metal manufacturing and shipbuilding.

The principal risk factors are the intensity (decibel level), frequency, duration of exposure and application of safety procedures.

The door was opened for employees to claim damages against their employers in 1963 by a change in the statute of limitations and publication of the Government booklet "Noise and the Worker". The first successful claim was made in 1971 and the trickle of claims that followed became a flood in the late 1970s and this has continued into the 1980s. The claim pattern has been influenced by the involvement of trade unions and the rate at which they can handle claims on behalf of their members.

The size of claim depends upon the level of hearing loss and the presence or absence of tinnitus (a ringing, buzzing or whistling sound in the ears). The majority of claims are for general damages and are typically between 1,000 and 4,000, although claims of 15,000 or more have been made.

A number of insurers and trade unions have entered into agreements to settle claims according to a sliding scale which usually depends on the claimant's age and level of hearing loss, and to apportion the claim between insurers who have been on risk during the exposed period, on a pro-rata basis, subject to a start date which is usually 1st January 1963.

g) Tenosynovitis (Repetitive Strain Injury or Upper Limb Disorder)

Tenosynovitis is the inflammation of the tendons arising from repetitive movements. There have been increasing reports linking tenosynovitis with certain occupational activities, with the earliest claims being reported in the late 1970s.

Studies have shown that jobs associated with repetitive strain injury include cleaners, hairdressers, VDU/keyboard operators, butchers, music teachers and machine operators.

Repetitive movements are defined as being at least one per minute. Those that are associated with injury include gripping in the palm with fingers and thumb, bending the thumb, twisting the wrist, rotating the shoulder with the arm raised and holding the thumb in a fixed position.

h) Vibration White Finger

Vibration white finger is a neuropathic and vascular disease affecting the hands and fingers. It can be caused by the use of vibratory equipment and is associated with occupations involving activities such as riveting and drilling which often also give rise to occupational deafness.

Very few claims were reported until 1984/5 since when the number of claims has increased significantly.

The majority of claims vary in size between £500 and £1,500. The trade unions have been heavily involved in representing their members and presenting their claims to insurers. As for occupational deafness claims, a number of agreements have been made between insurers and trade unions as to the scale of damages that are payable and claim apportionment operates in a similar way.

The number of claims notified to UK insurers has, according to ABI statistics, increased from approximately 150 in 1984 to 10,000 in 1988.

3.4 <u>From whence cometh the next generation of Latent Claims?</u>

The potential for long-tail claims from the above sources, and indeed from many others, is well documented and understood. However, there will always be others which are as yet unforeseen.

AIDS is sometimes spoken about as having all the characteristics which might make it the subject of tomorrow's latent claims. However, a more reasoned examination of the nature of the epidemic makes this possibility seem less likely. Those who may have the strongest case for establishing a claim are the haemophiliacs or others who have been infected by contaminated blood products. However, such people are generally monitored very closely as a result of which the delay between infection and discovery will normally be quite short. Furthermore, in most countries - certainly those in the "first world" - blood products are closely screened to avoid the risk of further infection from this source.

In general there is little risk of infection being spread in the normal workplace and thus there should be little chance of large volumes of legal actions against employers.

But, even if the risk seems remote, one should not be too complacent - especially where one is exposed to the vagaries of the American legal system. Is it too far-fetched to imagine that an enterprising lawyer might come up with a class action against the pharmaceutical industry for failing to come up with a cure?

If, in latent claim terms, AIDS is not to be the villain of the future, then what else? Perhaps in the years to come one can envisage a new disease afflicting Lloyd's underwriters which we shall call RAS (Risk Aversion Syndrome) or ORS (Outhwaite Reaction Syndrome). This is where long exposure to mounting losses on the back years induces a temporary paralysis, preventing the underwriter from putting pen to slip. It seems plausible - and potentially expensive!

4. THE PROBLEMS OF LATENT CLAIMS

4.1 Processes rather than events

Traditionally, policy wordings were written in terms of sudden events where it is usually easy to determine how many there have been and when each one happened. However, latent claims may not stem from sudden events, and it is often far from easy to determine how many there have been and when they happened. These issues are of great importance, as they determine which policy or policies must pay for the claim, how many excesses (or self insured retentions) the insured must bear, and how many policy limits the insurer may have to pay.

We have seen earlier how latent diseases may be either progressive or truly latent. In the case of a progressive disease, developing over many years, it may be argued that the damage done in each policy year constitutes a separate claim. This will be of benefit to the insurer if the claims are relatively small, since the insured will have to bear the excess in each policy period, and this may represent a large part of the claim. On the other hand, if the claims are relatively large, the insurer may have to pay his full policy limit in each period of insurance, rather than only one policy limit per injured person. In the case of truly latent diseases, however, it may be argued that there must at some time have been a trigger mechanism which launched the progress of the disease. That would tend to suggest there has been only one claim, although one still may not know when it happened. In this case the insured would bear only one excess, and the insurer would be exposed to at most one policy limit. In practice, it is not always clear whether a particular disease is progressive or latent.

Modern policy wordings in the UK domestic market usually make it clear that when a claim is attributable to continued exposure to conditions over a period of years, then each period of exposure to each individual party constitutes a separate claim. However, older policy wordings were much less explicit and it is clear that those who have to deal with the claims will have great difficulty in determining the correct treatment.

4.2 Age of Claims

Another feature of latent claims which gives rise to additional difficulties in handling and reserving is that many date back a considerable number of years. This, coupled with the fact that they frequently span a number of policy periods, gives rise to problems in the following areas:

a. Claims Handling - It is obviously more difficult for claims staff and for the courts to establish the facts after a long passage of time. Memory will have faded, witnesses will be hard to trace, and work and medical records may be missing or incomplete. It may be difficult to establish the state of knowledge of both plaintiff and defendant at the time the injury took place, and it may be difficult to get both parties to bear in mind the state of the law at that time.

b. Policy Records - Both the insured and the insurer may have difficulty in tracing policies which date back many years, and the insurer may not have retained his underwriting files. Inevitably, details of the older policies will not have been loaded onto the computer system, which presents additional problems.

c. Policy Wordings - The wordings of the applicable policies may well be old fashioned and unfamiliar, and may have changed over the period of the claim.

d. Policy Conditions - Likewise, policy conditions may be out of date and may have changed over the period of the claim. For example, a policy limit that seemed quite conservative in 1950 may appear totally inadequate today.

e. Change of Insurers - The insurance may well have been placed with a number of insurers, perhaps scores, over the period of the claim.

4.3 Number of Claims

As mentioned above, the fact that most latent claims stem from processes rather than events makes it difficult to establish how many claims there have been and when they happened. There is also the argument that, because each injury is due to substantially the same cause, all injured parties constitute just one claim. By analogy, several individuals may be regarded as one claim if they are all injured in one explosion. There may also be additional clauses specifically designed to aggregate claims together for the purpose of applying the policy limits and deductibles.

There are, therefore, many competing theories about what constitutes one claim, for example:

a. Each year of insurance for each injured party

b. Each individual injured party

c. Each year of insurance for all injured parties together

d. All injured parties at any one location

e. All parties injured by one type of product

These issues must be resolved in the light of the circumstances of each case and the definitions in the relevant policy wordings. If this were not enough, the circumstances, the policy wordings and the policy conditions may well have changed over the period when the injuries are thought to have been caused.

4.4 Trigger of Coverage

If damage or injury is thought to have been caused over a number of years, it is necessary to decide which policy or policies must contribute to the cost of the claim. Again there are a number of competing theories, of which the three most important are:

a. Manifestation. Here the loss is deemed to occur when the disease is first capable of diagnosis, or the damage first capable of observation. This theory clearly triggers only one policy for a given claim.

b. Exposure. Here all policies in force during the period of exposure to the conditions deemed to give rise to the claim are required to contribute to the loss. In this case, one may spread the loss uniformly over all policies, although some courts have allowed the insured to select the policy under which he wishes to claim.

c. Injury in fact. This is the most logical theory. It says that policies in force when injury actually took place must contribute to the loss.

In one well known decision, the "Keene" decision, the court held that all policies in force from first exposure to manifestation are triggered, and the insured can recover from any one or more of these policies. This trigger theory is sometimes referred to as "continuous trigger" or "triple trigger". See 5.3

4.5 Reinsurance and Excess Layer Issues

The above issues will also affect reinsurers and excess layer (umbrella) insurers. However, in the case of reinsurance, there may be a different definition of what constitutes one claim, or there may be separate explicit aggregation conditions. Again, these conditions in the reinsurance policy or treaty can be very difficult to interpret in the context of continuing processes rather than sudden events.

5. ASBESTOS BODILY INJURY

5.1 General Background

Asbestos is a naturally occurring, fibrous mineral with high tensile strength and flexibility, and good resistance to heat, abrasion and many chemicals. There are two basic types:

1. Long fibre (white) asbestos which is used in woven products.
2. Short fibre (blue) asbestos which is used in building products.

Asbestos has been used since biblical times, but increasingly since 1950 in steam engines and boilers, and more recently in building products. The heaviest exposures were in the 40s and 50s, and it is estimated that in the US up to 13M workers and their families have been exposed to asbestos dust between 1940 and 1980. The dangers of dusty conditions have been known for a long time, but the special dangers of asbestos were not generally recognised until early in the 20th century. Regulations to limit the amount of asbestos in the air were introduced in 1938 at the level of 185 fibres per cc. This persisted until 1971 when a new threshold of 12 fibres per cc was introduced. The limits were further reduced during the next 10 years to a level of 0.2 fibres per cc.

There are 4 main types of disease associated with asbestos dust:

a. Asbestosis - similar to other dust induced lung diseases

b. Mesothelioma - cancer of the lining of the lung cavity, which is particularly associated with asbestos

c. Bronchial cancer

d. Other cancers

The claimant has to show that he has suffered injury, that it was caused by breathing asbestos dust, and that liability for the situation falls on the policyholder. In principle, this situation is no different from any other industrial injury or disease, but asbestos claims tend to be more expensive both to settle and defend than many others.

5.2 The US Situation

The situation in the US is unusual in that most claims are being made not against the employer but against the producer of the asbestos product. The main reason for this is that US Workers' Compensation Acts provide no-fault compensation to injured workers, but at strictly limited levels. Claims against the producers have to show liability, but are not subject to any limit. Some groups of workers, however, such as railroad workers, are covered by the Federal Employers Liability Act (FELA) which is not subject to these limits, and asbestos claims from such workers are being lodged against the employers.

The fact that most asbestos injury claims are being made against the asbestos producers has two important consequences:

a. Instead of being spread across all employers who used asbestos products, the claims are concentrated into the relatively small number of companies who produced asbestos or asbestos containing products. Something like 80% of current claims are coming from only 30 major asbestos producers.

b. The claims constitute product liability claims, and most Comprehensive General Liability (CGL) policies have a separate, aggregate limit for product liability claims.

This results in relatively few, very large claims, so that, other things being equal, a high proportion of the total cost falls upon excess layer insurers and excess of loss reinsurers. In fact, a number of the original policies have already become total losses, and we understand that some major producers have already used all of their available insurance coverage.

5.3 Asbestos Bodily Injury Litigation

As mentioned above, asbestos injury claims are complex and expensive to defend. It has been suggested that in the early days, two thirds of the insurance money being spent was ending up in the pockets of the attorneys.

There was fairly extensive coverage litigation (Declaratory Judgement Actions or DJAs) in the 1970s and early 1980s, although this has been substantially reduced as a result of the Wellington Agreement. Most of this contention focused on trigger of coverage and number of claims, and this did not go well for insurers. In 1981, in Keene Corporation VS. Insurance Corporation of North America, the court held that the policy language was ambiguous and the insured could claim against any policy in force from first exposure to manifestation. This became known as "triple trigger", and was a major factor in the development of the Wellington Agreement.

5.4 The Wellington Agreement and the Asbestos Claims Facility

The Wellington agreement was an agreement signed by many of the major asbestos producers and their primary and umbrella (excess layer) insurers. The main provisions of the agreement are:

a. The cost of claims would be spread uniformly over all policies in force during the exposure of the injured party to asbestos.

b. A commitment to use the techniques of alternative dispute resolution (ADR) so as to reduce the defence costs.

c. An undertaking by insurers to continue to provide defence costs even after indemnity limits were breached.

d. An agreement to share the costs of claims in agreed proportions between the producers and their insurers.

e. Agreement to establish a claims handling facility on behalf of all producers and their insurers, to achieve economy and consistency in claims handling.

The sharing agreement was important because many of the injured parties would have been exposed to the products of more than one producer, and it was complex and expensive to resolve the shares of each producer on a case by case basis.

This agreement applied to injury claims only. The Asbestos Claims Facility (ACF) started operations in June 1985, and was said to have a dramatic effect in reducing defence costs. It has been suggested that it also had the effect of accelerating claims payments. In addition, claims started to emerge from new industries, such as tyre manufacturers who used asbestos in the powder used in the moulding process. The two features of acceleration and changing mix led to strains within the ACF, and eventually it was disbanded in October 1988. The remainder of the Wellington agreement, however, is still in effect.

5.5 The Centre for Claims Resolution (CCR)

Following the break up of the ACF, a number of former members and their insurers formed the CCR as a successor organisation. We understand that the CCR has achieved even lower expense costs than the ACF, and that those who withdrew from the ACF have seen their defence costs increase to pre-ACF levels or even higher.

5.6 Reinsurance and the Aggregate Extension Clause

Because most asbestos injury claims are product liability claims, the original covers were mainly written on an aggregate basis. Many excess of loss reinsurance treaties include an aggregate extension clause, which applies to claims made on original policies written on an aggregate basis. The effect is to allow the cedant to aggregate all claims from one original insured in any one year under policies written on an aggregate basis, and to treat these as one claim for the purpose of applying the limit and deductible under the treaty. We understand that a corresponding clause in the reinsurer's outward treaties will allow the reinsurer to aggregate all claims from one original insured for the purpose of applying limits and deductibles on the retrocession policies.

Fortunately, the aggregate extension clause was fairly widely used, as the reinsurance treatment of asbestos injury claims can be quite contentious in the absence of that clause. Some treaties may include different clauses, permitting other forms of aggregation, which may be deemed to have a similar effect. In other cases, the cedant may try to argue that all injuries stemming from exposure to a given product constitute one claim under the original policy and that this too gives a similar effect. Many of these issues are not yet finally resolved. However, since most reinsurance treaties include arbitration clauses, it is likely that most of these issues will be resolved in arbitration rather than in the American Courts.

Further details of the aggregate extension clause issue can be found in the London Market position papers on this subject, which we understand are currently being revised.

A number of reinsurers, particularly European reinsurers, argued that the Wellington Agreement modified the terms of the original policies, and invalidated the reinsurance claims. This issue too remains unresolved, but we understand some of those who at first rejected asbestos claims have now begun to pay those claims.

5.7 The Scale of the problem

It is difficult to get authoritative information about the number and cost of US asbestos injury claims. However, we believe that around 150,000 individuals have so far filed claims, and we believe the average compensation paid is in excess of $80,000. Defence costs would be in addition, and may be of similar size. We understand that there are currently around 2,000 new notifications per month, with no sign of any reduction. It may well be that the major producers will run out of cover before they run out of claims, and this may be the feature which limits the insurance industry's liability. On the other hand new insureds may emerge against whom liabilities can be proven. At the current rate of progress, it seems that the ultimate insured liability could be some tens of billions of dollars.

6. ASBESTOS PROPERTY CLAIMS

6.1 General Background

Asbestos fibres have been incorporated into a large number of building products, in particular in the insulation surrounding boilers and central heating pipes. These components can become damaged in several ways, leading to the release of asbestos fibres into the air within the building. It is alleged that this constitutes a hazard to the occupants of the building, and that the damage should be repaired or the asbestos removed. In addition, when a building reaches the end of its useful life, it may be more difficult and expensive to demolish if it incorporates asbestos in its structure. The costs of removing asbestos from buildings can be very high, in some cases exceeding the market value of the building. This situation is giving rise to insurance claims in the US not only against the insurers of the asbestos producers, but also against the first party property insurers and against the insurers of the architects who specified the material in the first place.

6.2 Legislative Background

In 1973, National Emission Standards for Hazardous Air Pollutants (NESHAP) were introduced under the Clean Air Act. The main provisions were to limit the emission of asbestos fibres into the air, to regulate the removal of asbestos from buildings during demolition, and to apply a partial ban of spray-applied asbestos-containing material in new buildings.

In 1980, the Asbestos School Hazard Detection and Control Act called for a survey of all schools in the US to determine the level of asbestos fibres in the air.

In 1986, the Asbestos Hazard Emergency Response Act (AHERA) required the Environmental Protection Agency (EPA) to establish a programme to remove friable asbestos from schools, and to survey all public and commercial buildings. It is estimated that asbestos will have to be removed from 35,000 school buildings at a cost of over $3Bn. It is also estimated that over 300,000 public and commercial buildings contain friable asbestos which will have to be removed at a cost of over $50Bn. In addition, there are numerous private buildings and domestic houses which contain asbestos, and where claims for removal may be expected.

6.3 Third Party Claims

The liability claims against the asbestos producers make a number of allegations, including negligence, express warranty, implied warranty, nuisance, trespass, fraud, conspiracy, strict liability, market share liability and liability under the Comprehensive Environmental Response, Conservation and Liability Act (CERCLA). The asbestos producers generally deny liability on several grounds including:

a. Statutes of repose - many states have statutes providing an absolute bar on claims for building defects after a specified period, often 20 years.

b. Statutes of Limitation.

c. Economic Loss Defence - it is argued that the mere presence of asbestos in a building does not constitute physical damage, and hence any loss is an economic loss only and not recoverable.

d. Product Identification - basically the claimant has to prove that the defective product was manufactured by the defendant.

e. No Risk - the argument here is that properly maintained asbestos-containing components do not constitute a risk.

In addition, insurers may deny policy coverage on a number of grounds, including:

a. No "property damage" - in other words the loss claimed against the policyholder does not constitute property damage as defined in the policy.

b. Policy Exclusions - there may be specific exclusions, such as the pollution exclusion.

c. Trigger of Coverage - the defence is that actual damage did not occur during the policy period.

d. Expected or Intended - the argument here is that the consequences were foreseeable and there is thus no fortuity as required by the policy.

e. Non-disclosure - insurers may be able to claim that insureds concealed information about the dangers of the product, or that there were suits pending which were not disclosed at inception.

f. Late Notice.

6.4 <u>First Party Property Claims</u>

There have already been a number of claims submitted to first party property insurers, and a few against the architects who specified the asbestos containing product in the first place. The first party claims are against policies with all risks wordings, where, in effect, the onus of proof may be on the insurer to show that a claim is not covered.

It is not yet clear how numerous these types of claim will become. However, we understand that W R Grace, in an out of court settlement with various school districts, obtained an assignment of rights under the school districts' first party policies. We are not aware that any attempt has been made to exercise any of these rights.

6.5 Reinsurance and Excess Layer Issues

It is fairly common for primary liability (CGL) policies to provide separate limits for injury claims and property claims. However, excess layer policies and excess of loss reinsurance policies often provide a combined limit for both injury and property claims. In many cases, therefore, even if property claims are upheld, they will run into the same policy limits as the injury claims. On the other hand, there is the possibility that other producers will emerge whose products have not given rise to large numbers of injury claims, but which have been widely incorporated into buildings.

The Wellington Agreement does not apply to property claims, and the arguments that the agreement modified the terms of the original policies would not therefore be available to reinsurers when dealing with property claims. However, there may well be parallel disputes concerning the issues of number of claims and trigger of coverage.

7. RESERVING FOR ASBESTOS CLAIMS

7.1 General Comments

A number of fundamental issues are relevant to the projection of asbestos losses. We should consider separately: Bodily Injury Vs Property Claims Vs FELA; Direct business Vs Reinsurance (which can be split down into pro rata, XL, with or without an aggregate extension clause and Retrocessional); Facility Vs CCR Vs Other.

If we are considering figures net of outwards reinsurance, allowance for failure of reinsurance security and gaps in or exhaustion of reinsurance coverage need to be considered.

The traditional triangulation approach fails, as the development of losses shows very little dependence on duration from the underwriting year to which losses attach. Rather, the loss development has shown an increasing profile from the mid-70s with surges following milestones in the litigation processes alternating with periods of relatively gentle increase; over the years the insureds involved in bodily injury claims have broadened from the major producers to users of asbestos and more recently US railroads under FELA.

7.2 Alternative Methods

a) Measure exposure to asbestos losses and take a view on the likely degree of impairment, either in total or by segment.

b) Reserve the policy limits on any policy where a loss has been notified.

c) Develop a demographic model which gives the likely quantum and date of maturity of loss development and the rate of emergence of insurance losses. There is much published research which takes account of the population of various workers exposed to asbestos since the 1930s, the onset of asbestos-related diseases, the level mortality and other factors.

   This gives an overall industry view of development, which may help to assess the effect on the particular insurer.

d) Use information on the flow of claims to the ACF to make projections for the ACF and its successor the CCR. Experience to date may suggest that the insurer's share of overall ACF payments is fairly stable. This then enables projected losses for the insurer to be derived from ACF projections. A grossing-up factor would then be applied to allow for losses from producers outside the ACF or the CCR.

e) Various empirical approaches:

   Apply a percentage loading to outstanding claims or incurred claims.

Take a multiple of the development of incurred claims in a recent period (e.g. the latest year or the average of a few years).

f) Model the number of claims to the insurer and the average incurred cost per claim separately. For example, treat each underwriting year's involvement on each assured as a separate claim; for bodily injury the overall average cost per claim seems to have been fairly stable over the past few years although when current average costs are broken down to underwriting year there is considerable variation. An ultimate overall average cost is selected judgmentally. The projection of numbers of new claims is more problematic as past experience in some categories shows only slight slackening off in recent years. However, the year when the ultimate number of claims is expected to be reached is selected judgmentally and the graph of past numbers is extended either by eye or by experimenting with various Craighead curves. The results appear to stand up fairly well to monitoring for bodily injury.

g) The unique features of the US situation present additional problems in reserving, but may also provide an alternative approach. As the majority of the claims are being concentrated on a small number of producers, and on a section of the policy which is subject to an aggregate limit, there may be some merit in reserving on the basis that all coverage purchased by the major producers will ultimately become a total loss. A case study describing one company's experience of applying these ideas is included as Appendix IV.

The more detailed of the above methods may be reasonably applied to estimate bodily injury but property claims involve greater uncertainty as significant decisions in litigation are still awaited with no clear trend established.

8. ENVIRONMENTAL POLLUTION

8.1 General Background

For the most part of the 20th century, unwanted items of waste have been stored at numerous dump sites, and various other items have otherwise been stored for future use. Some of these items are harmless, others have been stored competently and efficiently. Unfortunately, some items have caused problems. Leakage or spillage has occurred, combinations of materials have chemically reacted and some sites have shown latent environmental problems. This section describes the salient features of environmental pollution, although pollution such as that resulting from oil spillage is not addressed.

In view of the prominence of US latent claims, and the actions of the US courts and government in relation to environmental pollution, this section concentrates on the situation in the USA.

8.2 Type of claims arising

Even if the insured is not ultimately held liable for pollution losses, the insurer may still incur costs, as he may have a duty to defend suits which allege liability which would be covered by the policy. Such defence expenses may well be substantial, and there are frequent disputes about whether an Environmental Protection Agency (EPA) clean up order constitutes a "suit", or whether the alleged wrongs would be covered.

There are three types of indemnity claims:-

a) bodily injury - some environmental pollution has an adverse effect on health. For example, a leaking underground storage vessel may contaminate drinking water supplies and cause injury.

b) third party property damage - if spilled or leaked contaminants pollute adjacent land owned by others.

c) clean-up - the original site may need to be repaired and cleaned up, and these costs may be recoverable from the insured..

In addition, there may be claims for the cost of:-

a) Ongoing monitoring of the site
b) Medical monitoring of local residents
c) Investigation and development of a plan for remediation.

So far, most claims have been made under Comprehensive General Liability (CGL) policies, but increasingly claims for the cost of cleaning up the site itself are being made against the first party property policy, often under the debris removal section. This paper concentrates on third party claims.

8.3 Examples of Environmental Pollution in USA

a) Love Canal

In 1894, William T. Love started the construction of a canal that would link the Niagara River with Lake Ontario. The intention was to provide hydro-electricity and water. The invention of the alternating current motor made the operation economically impractical. Construction was halted and what was left was a 15 acre trench - ideal for dumping.

In 1947 Hooker Chemical purchased the trench and from 1947 to 1952 proceeded to dump some 21,800 tons of toxic chemicals into the trench. When this was done, the site was sold (in 1953) to Niagara School Board for a nominal $1.00, subject to a disclaimer of responsibility for injuries arising from the buried chemicals.

Hooker had sealed the dump with a clay seal. After building the school, which was on the dump, the land which was <u>not</u> on the dump was sold for private residences. However, in construction, two streets plus a state expressway were built across the dump, which seemed to break the seal.

In the period 1971-1977, following heavy rains, a mixture of no less than 82 industrial chemicals seeped into the playground of the school and the basements of the new houses. Eleven of these chemicals were suspected carcinogens.

The history of subsequent events is as follows :-

August 2nd, 1978 - New York State Health Commissioner declared a health emergency recommending closure of the school and the evacuation of pregnant women and children from the nearby houses.

August 7th, 1978 - President Carter approved emergency financial aid. 298 houses were purchased by the State of New York at a cost of $10 million.

August 10th, 1979 - A House of Representatives subcommittee released documents indicating that Hooker knew in June 1958 that chemicals were seeping into the residential area.

Claims have been made by 1,000 parties, but the most important was the $635 million lawsuit filed by the Attorney General for the State of New York on April 28th 1980. This was against Occidental Petroleum Company and its two subsidiaries: Hooker Chemical and Hooker Chemical & Plastics.

Little development has occurred on the legal side but Love Canal has recently been found to be habitable again. Two thirds of the area is deemed suitable for residential use.

b) Times Beach

International Petroleum Corporation was a chemical company which was wholly owned by Charter Oil. This company produced dioxins as a by-product and arranged for their disposal at a recognised dump site. The contractor, Russell Bliss, was aware of the toxins and said they would be disposed of at an official E.P.A. site.

It is alleged that Russell Bliss did not dispose of the toxins in the prescribed manner. It seems that various chemicals were mixed with oil and then sold to contractors to spray on dusty roads. Russell Bliss had no insurance coverage, no assets, and is bankrupt. Charter Oil (and their insurers) are the only people who can be sued.

Times Beach is a test case. It is a few miles out of St. Louis on the banks of the Meranac River. It is a shanty town which should never have been built - it floods after heavy rain. After one such flooding, when the town was evacuated for several days, they were proposing to return only to be told that all their roads had been sprayed with dioxin-laced oil, they had been breathing the dust for years, the flooding meant their homes were probably contaminated, and the evacuation should be permanent.

The level of toxin is 130 times the currently assessed highest safe level of one part per billion. In 1974, 60 horses mysteriously died in one stable - it was discovered that oil had been sprayed on the stable riding paths.

In 1988, the EPA promulgated its Record of Decision selecting the use of a mobile incinerator as the method of remediation. The cost of incineration is estimated at $120M. The governments's choice of remedy is being disputed by Charter Oil.

c) Stringfellow

The Stringfellow site covers 22 acres of land near Glen Avon, California. Stringfellow Quarry Company operated the site until 1972, and, in 1974, owing to financial difficulties, ceased to maintain the site. The site was taken over by County officials in 1975.

In 1956, a liquid waste disposal facility was located at the site. From then on, 200 generators disposed of some 34 million gallons of chemical and hazardous waste.

By 1968, soil discolouration was noted, and, in 1969, a dam overflowed with a substantial release of waste into Pyrite Creek. The California Public Health Officials did not declare a public health hazard. In March 1969, the site was closed for chemical waste disposal, and in 1972, Mr. Stringfellow voluntarily closed the site.

From 1972 to 1974, Mr. Stringfellow tried to maintain the site, but leakage from cracks in the base of the dam meant that this was not possible. In January 1975, the site was declared a public nuisance.

Studies made at the site indicated leakage through porous sandy subsoil, and by 1978 a remedial action plan was recommended. However, in March 1978 the main dam overflowed and 1.5 million gallons of water flooded from the site (including 800,000 gallons released to prevent the collapse of the dam). Waste had been removed from the site in response to further emergencies. The cost of the clean-up was estimated at between $96 million and $334 million (May 1986). On 21st April 1983, California and E.P.A. sued Mr. Stringfellow and 22 generators (or PRP's - Potentially Responsible Parties) for $42 million.

The draft Feasibility Study report released in June 1988 contained the proposed plan for groundwater clean-up in the Glen Avon community and various alternatives for remediation of the on-site area. The estimate for total clean-up costs is at least $600m.

d) Shell Rocky Mountain

This is the prime case that has been "won" by insurers in the denial of coverage. The case may be summarised by the quote of Barry Bunshoft to the jury.

"The Shell Oil Company for 30 years gave profit for production of pesticides a higher priority than the protection of the environment. Shell Oil Co. continued the practices that were polluting the Rocky Mountain Arsenal from the first day it leased the arsenal until the day it folded and left in 1982, leaving behind it the most polluted place on earth."

The history of the 17,000 acre site is horrific. The clean up cost is estimated at between $3 Bn and $4 Bn.

The key to the success of the Court Case was possibly an internal Shell memorandum of July 1965 which warned that the disposal method could cause injury to humans and animals. Following this memorandum, the dumping in open pools ceased and a 12,000 foot well was used. The injection of wastes down this well unfortunately caused an earthquake! Shell subsequently reverted to its old practices of disposal.

In 1955, U.S. scientists linked the deaths of ducks to the contamination of the sites. This followed the death of 1,200 ducks alone in 1952. Stories of "dead duck removal" prior to inspection were reported in the case.

In 1960, a U.S. Army study indicated the 11 per cent of wastes deposited into the sewer system was leaking and contaminating underground water.

In 1965, a Shell executive said he saw drums of unprotected waste leaking into the soil. By 1968 Shell had piled 6,775 drums into the dump site. The U.S. Army allowed Shell to dump these leaky drums free.

In 1974, dairy calves at a farm near the site started dying and people who worked on the farm became ill with vomiting, sores and loss of hair.

The jury consultants report indicated that the key theme was the pattern of evidence, and the main theme was "expected or intended" dumping. One witness, Mr. Knaus of Shell, was so thoroughly discredited in cross examination that they were unwilling to accept the credibility of any part of his testimony in support of Shell.

The jurors also failed to agree that Shell had permission to use the site for waste disposal. Indeed, there was a clause in the lease saying Shell should not pollute. The dead ducks were also an important point which indicated, to the jury, that Shell wished to "bury its head in the sand".

The Shell profit motive was also an important consideration for the jury.

This case is subject to appeal, and further developments are awaited. This process may take several years.

8.4 <u>U.S. Government Organisation</u>

Prior to 1971, the only powers on the statute were the 1965 Clean Air Act and provision for general nuisance and trespass.

The Environmental Protection Agency (EPA) was created in 1971 in response to the concerns voiced in relation to pollution.

In 1980, the Comprehensive Environmental Response, Conservation and Liability Act (CERCLA) was passed. This act imposed potential liability on anyone who deposited, transported or created any of the toxic materials found at abandoned toxic waste sites. Such people were known as Potentially Responsible Parties (PRPs). The act also required the EPA to remedy hazardous sites by:-

a) forcing PRPs to clean up sites (by injunction)

or b) cleaning up directly and recovering the costs from PRPs

or c) Suing PRPs for damage to the environment.

The Act also provided a fund (Superfund) to enable the EPA to investigate and remedy the sites, and to meet the shares of PRPs who could not be found or were insolvent (the "orphans' shares").

In 1986, these powers were extended under SARA (Superfund Amendment and Reauthorisation Act) which tightened up CERCLA, provided more financial assistance for pollution control, and entitled communities to have a "right to know" what hazardous materials were being produced/stored/ emitted by local businesses.

CERCLA comes up for re-authorisation in 1991, and negotiations are in progress to extend its powers and those under SARA, the RCRA (Resource Conservation and Recovery Act for existing and currently used sites) and the Clean Air Act, beyond 1991.

It is proposed to up-grade the EPA to a US Cabinet Department in the near future in order to strengthen US environmental protection efforts.

In 1980, 50 people were employed by EPA to police pollution in USA. This number is now over 2,000. Active waste sites are more carefully controlled.

In addition to these Federal statutes and the EPA, many states have their own statutes and enforcement agencies, often called the Department of Natural Resources (DNR).

8.5 USA Pollution Problem

Pollution claims cover a wide range of situations, are subject to a wide range of legal and factual disputes and involve a large number of American companies, jurisdictions, policy wordings and coverage profiles. Already, different courts are giving different decisions on essentially the same legal questions, so we are unlikely in the near future to end up with a consistent legal framework for pollution litigation throughout the US. Many decisions depend very heavily on the specific facts of the case, so it is likely to be quite some time before clear guiding principles emerge, even in any one of the 50 US States. A brief description of the main legal issues is included in the Appendices.

Many of the coverage issues are inter-dependent, so that the consequences of a decision on one issue may depend on the outcome of another. For example, one or more variants of the pollution exclusion is currently challenged by insureds as being ambiguous. If the courts uphold the exclusion, then those policies which contain it will usually make no payment. However, unless all potentially triggered policies contain the exclusion, the insured is likely to argue that he can recover his whole loss from the earlier, unprotected policies. If the courts agree, the earlier policies will pay more than they would have done had the pollution exclusion failed. Moreover, the loss may penetrate excess layers of coverage which, prior to the decision, were deemed to have no liability.

The only general statement you can make about pollution is that you cannot make general statements about pollution.

Quite apart from the legal uncertainty, there are often several quite different estimates of the cost of cleaning up any given site. The doctrine of joint and several liability makes it difficult to predict accurately the share that any given insured may have to bear. There are estimated to be up to 400,000 abandoned toxic waste sites in the US, and so far just over 1,000 are on the National Priority List (NPL), of which only about 30 have been cleaned up. There is thus considerable uncertainty about the unreported liability. Even if all sites and PRPs were known, there would still be uncertainty about what coverage had been issued. Many of these claims date back several decades, and even direct insurers may not have complete records of all policies written over the entire period. For reinsurers, even if they have full records of their reinsurance issued, they are still dependent on their cedants for details of original policies. The LMX market, of course, has its own problems.

The Office of Technology Assessment estimates the overall cost of cleaning up toxic waste sites at around $500BN. This does not include defence expenses, Declaratory Judgement Action (DJA) costs, third party claims, ongoing monitoring or the possibility of punitive damage awards. It does, however, exceed the combined capital and surplus of the US insurance industry.

Under the proposed Department of Environmental Protection Act, a Centre for Environmental Statistics will be created to oversee the collection of such data.

8.6 Non-USA Pollution Problem

a) Outside the USA, pollution costs go largely unreported in the media. However, there is growing awareness of the problem in Europe, and the situation is likely to deteriorate substantially in Third World Countries.

b) There has been recent European Community activity regarding environmental pollution, and a "Green Bill" is being passed through the UK Parliament at the time of writing. The Government published its Environmental Protection Bill (to tackle pollution) on 20th December 1989. It introduced new pollution control systems and stiffer penalties for pollution, and completed the overhaul of pollution control systems that began with the Water Act 1989.

c) There are large industrial areas in Europe that have been active for most of the 20th Century. There are certainly considerable numbers of pollution sites:-

   Midlands & North of England, Ruhr and Rhine valleys,some areas of Belgium and Holland,...

d) Serious incidents have been limited to date:- The village of Lekkerkerk in Holland (US$70M), Unna in West Germany, Roissy and Garonne Basin in France.

8.7 Coverage

Insurers generally maintain that clean-up costs for gradual environmental pollution losses were not intended to be covered by comprehensive general liability policies. Some explicit attempts were made in the policy wordings in later years to clarify the exclusion of such losses.

When some policies were found by certain U.S. Courts to be liable to pay such losses, against the intent of both parties at the inception of the policy, problems of claim definition arose. Whereas for a sudden event the date of loss is not normally an issue, for these latent claims the pollution may have occurred over a number of years. Hence different trigger of coverage theories have emerged:

a) Exposure - policies in force during the period that the plaintiff was exposed.

b) Manifestation - policies in force when the problem was first discovered.

c) Injury in Fact - where proof of injury is established on a case by case basis, all policies in force when damage in fact results.

d) Continuous Trigger - all policies from exposure to manifestation.

A recent development has been the suggestion that the Personal Injury extension of the CGL policy may provide indemnity. This is a complex issue in its own right, and has yet to be tested in the US Courts.

8.8 Specific Reinsurance Problems

Whereas the insurer is concerned about the coverage of the insured, the reinsurer has concerns about the aggregation of claims. The method of aggregation used has a dramatic effect on the claims payable by the reinsurer. If one site constitutes one claim, then he is far more likely to be called upon to pay than if a claim is determined to be per site, per underwriting year, or even per dumping.

9. RESERVING FOR ENVIRONMENTAL POLLUTION

9.1 The Problem

In most projections of losses, we have some prior history of loss development. We assume that this can give some guidance to the future, albeit with allowance for other factors. However, for environmental losses there is no past development, but there may be future losses. At best, there will be legal expenses of various types; at worst, substantial indemnity payments and expenses.

The concerns of insurer and reinsurer will differ in some respects, but the underlying problem of lack of data and uncertainties as to the outcome of court legal actions are common to both.

9.2 Reserves for Known Involvement

The results of the survey (Appendix X) suggest that the most common approach to reserving for known involvements is to adopt the "reserve potential" provided by the US Attorney. As coverage for claims that do not fall within stated coverages is being denied, it is clear that this is not an attempt to estimate the likely cost of known claims, but a convenient device to build a "fighting fund" to meet the cost of the Declaratory Judgement Actions (DJAs).

The basic approach to calculating the "reserve potential" is to estimate;

a) the cost of cleaning the site
b) the costs of third party claims and defence thereof
c) the insured's share of those costs
d) the number of years from first dumping or operation to first discovery of escape of toxic substances
e) the costs of defence of the insured
f) the costs of representation at, and preparation for, the DJA.

The total is spread over all years which are properly engaged, regardless of defences or pollution exclusion clauses, and the shares of primary and excess carriers worked out on the basis of the insurance profile.

It is tempting to imagine that this process gives a maximum possible liability in the event of losing all the arguments. Unfortunately the "reserve potential" does not represent an upper limit from which savings will be made if certain issues are won. For example, if the pollution exclusion is upheld, but the insured is allowed to recover his whole loss from the other policies, then the loss to those policies may be greater than the "reserve potential", and higher layer policies may be affected which have not yet been identified as being involved.

9.3 Addressing the Problem

The actuary cannot merely present these problems as an excuse for not producing a reserve. He may have access to some information that can be of help.

a) Monitoring Paid and Outstandings.

Subject to the problem described above, figures will probably be available by underwriting year and perhaps by type of pollution claim (as mentioned in section 8.2). It is helpful to provide details by insured and also by ceding company. In the case of a London Market company or Lloyd's syndicate, information should be split between direct business, LMX and other reinsurance.

As well as the indemnity costs, the legal expenses of pollution may be considerable. The monitoring should enable a split between the two to be available.

Just as important is the monitoring of outwards reinsurance recoveries. For reserving on a net basis, the ability of the reinsurers to pay is crucial. If substantial asbestos and pollution payments are to be met, some reinsurers will not be able to pay!

However, until data have been gathered and more losses incurred, normal statistical approaches cannot be employed.

b) Exposure Approach.

An attempt can be made to estimate the exposures for known PRPs under direct and facultative business, but records of very old policies may be missing or incomplete. Moreover, we may have yet to be notified of all the PRPs we insure, and there may be a significant IBNR problem.

For excess loss business, the problem is even more difficult. The required data are at least one step removed. Once known polluters have been advised to the reinsurers on a precautionary basis, some judgement can be used to produce a specific individual reserve.

On proportional business, the reinsurers may be given very little information. A good cedant may be helpful, but it is likely that only on loss notification will a reserve be available.

Exposure measurement may be full of uncertainty, but before data have developed it may be the only assistance to projection of pollution losses.

c) Decision Theoretic Approach

One suggestion for estimating the possible cost of reported claims is to model the uncertainty in the various legal issues, and make explicit assumptions about the probabilities of the possible outcomes. A worked example is included in the Appendices, based on a purely hypothetical example.

This approach can react quickly to emerging court decisions, and, using simulation techniques, can give a full probability distribution of possible reserves. The IBNR problem, however, is not addressed by this approach.

d) <u>Comparison with Asbestos BI Claims</u>

It is tempting to compare pollution claims to asbestos bodily injury claims, and in the short term this may be an acceptable option. However, the two types of claim have very different characteristics and are not really directly comparable. There are two main facets to this:-

(i) <u>Different Development Patterns</u>

Asbestos injury claims are comparatively simple and homogeneous:

- there are only a few identifiable diseases.
- many are traceable to breathing asbestos fibres.
- there were only a few major suppliers of asbestos.
- there was limited coverage litigation, and that was concerned mainly with number of claims and trigger issues, not with denial of coverage.
- the legal position became clear, and is thought to be relatively uniform across all States.
- a claims handling "Facility" was established to try to reduce the legal costs.

Pollution claims on the other hand are complex and heterogeneous, and coverage may be in dispute. There are also practical limits to how fast the sites can be cleaned. Thus pollution claims may not develop at the same rate as asbestos injury claims.

(ii) <u>Different Shares</u>

Most of the cost of asbestos injury claims is coming from a small number of major asbestos producers. The general view is that most or all of the available cover will ultimately be used. Thus the asbestos BI problem is characterised by total loss claims on most affected policies. This gives the maximum possible share to the excess carriers and reinsurers.

Pollution claims, on the other hand, are likely to involve a large number of separate sites and insureds, and exhaustion of insurance coverage is not regarded as the most likely outcome. Thus a larger proportion of the insured cost of pollution is likely to fall on the primary insurance market, and less on excess carriers and reinsurers.

In the short term, however, there may be no better alternative, and a development graph is included in the Appendices to assist with this approach. In the absence of better information, we suggest asbestos be regarded as starting in 1980 and pollution in 1985.

e) Rules of Thumb

Other more basic methods are being used in practice, (eg. IBNR equal to incurred or outstanding, or equal to the increase experienced in the last x years). A worked example appears in the Appendices.

f) Other Possible Outcomes

Some US insurers have made suggestions, including a levy that could be introduced on future comprehensive general liability, or even on commercial property, policies. This fund, and not past years' policies, would pay for the cost of clean-up. Hence, no reserves may be required!

9.4 Justifying the Solution

Clearly, with the lack of data and with many court decisions pending, the application of standard projection methodologies is rendered inappropriate.

However, for reasons of equity, taxation, reporting, etc., some method must be used. If the method has reasoned argument and some logic, then it would seem sensible to use that method rather than to give no assistance at all.

9.5 Conclusion

The uncertainties surrounding environmental pollution mean that no definitive answer to the question of how to reserve is available. However, the magnitude of the problem is clearly immense.

10. FUTURE WORK

The reader who has reached this far and who has also read Appendix II, Terms of Reference, will realise that there is much work still to do. Some of our objectives have been achieved in part, whilst an important objective relating to taxation is not yet within sight. However, we attach a copy of a Lloyd's Market Bulletin on taxation as Appendix XI, which may be of interest.

There is clearly more to do on techniques of reserving, but a necessary condition to significant advance in certain areas (such as environmental pollution and asbestos property claims) is a clearer picture on the legal issues. It also became apparent that many practitioners would benefit from regular briefing at an appropriate level on the development of these issues.

Over 50% of the respondents to our Survey of Development and Reserving Practices have confirmed that they would be willing to provide further information, including details of actual claim developments.

When this paper is discussed at GIRO, the Working Party will welcome any suggestions for the appropriate next steps. Possibilities that have occurred to us include:-

Do nothing

Institute to organise occassional briefings by qualified lawyers

Reconvene a similar Working Party to do more of the same, the terms of reference to depend on feedback to this report.

Organise some industry-wide collaboration on data and methodology, perhaps along the lines of the CMIR (Continuous Mortality Investigation Report).

APPENDIX I

Latent Claims W.P. Members

John Beck W.P. Leader

General Group	John Lockyer	Leader
	David Craighead	
	Colin Crouch	
	Haidee Pickton	
	Richard Wilkinson	
Asbestos Group	Graham Lyons	Leader
	Dewi James	
	Hugh Rice	
	Martin White	W.P. Secretary
Pollution Group	Colin Czapiewski	Leader
	Harold Clarke	
	Peter Copeman	
	David Sanders	

APPENDIX II

LATENT CLAIMS WORKING PARTY

TERMS OF REFERENCE

In order to focus our attention, we set ourselves the following objectives:-

1. Identify and describe the main types of latent claims.

2. Research the most important types of latent claims, and prepare position papers.

3. Identify and list sources of information and other interested organisations.

4. Describe the main approaches to reserving for latent claims.

5. Provide information and argument to support tax relief for reserves for future latent claims and for those which have been identified but remain very uncertain.

6. Propose a working definition of "Latent Claims".

APPENDIX III

Historical Development of Asbestos Usage

The contemporary growth of asbestos usage follows the industrial development of the western world. It was first used in a serious commercial way from about 1850 as a sealant in steam engine pistons because of its resistance to water, heat and friction and its insulating and sealing properties.

As early as 1898 specific mention was made of the damaging effects to the health of asbestos weavers caused by the dusty working conditions, but generally asbestos was not differentiated from other minerals in its harmful effects.

By 1918 an actuary, F. Hoffman, working for the Prudential of America, produced a work entitled "mortality from respiratory diseases in dusty trades", concluding that asbestos workers should be declined life insurance cover.

Deaths attributed to asbestos dust were becoming well documented by around 1927, which was when the term "asbestosis" seems to have been coined. By 1931 there were prescribed working practices established for asbestos producers in the UK, although none emerged until much later in the US.

In 1928 a Dr Lanza of Metropolitan Life made a more detailed study of the health impairment of asbestos workers, according to duration of exposure.

His conclusion was, roughly:

Years exposed	Proportion showing some Respiratory damage
< 5 years exposure	43%
5-10	50%
10-15	58%
> 15 years	87%

These results were published in 1935.

With the widespread recognition of the harmful effects of asbestos, why was so little done and why did claims for damages only really emerge in a serious way from the mid/late 70's? (Note that in 1970 the world production of asbestos was about 4 million tonnes).

Workers' compensation schemes were geared to provide cover against incidents with specific loss dates.
It was not intended to cover claims with the degree of latency of asbestos related claims. The only mechanism for compensation was through common law, claiming that the employers were being negligent. There were some suits along these lines, but few succeeded in the early days. As time went on there were increasing numbers of claims under workers' compensation schemes, as there still are today.

From the public health perspective, doctors were concerned less with unhealthy environments than with the health of individuals. Particular concern existed over the spread of infectious diseases such as TB and pneumonia, and although asbestosis sufferers may be prone to these diseases, asbestosis itself is not an infectious disease. In any case, it was regarded as less damaging than other prevalent industrial diseases such as silicosis.

Greater awareness of the problem began in the US at the end of the 1930s. This was driven by the upward drift in employment costs following the lean depression years. Increased labour costs reflected higher salaries and the introduction of group insurance schemes. Skilled workers in particular saw much higher living standards during this period. The insurance companies offering group life and health cover would have been careful to monitor the schemes' experience and ensure that the premiums charged were adequate. This produces a trend towards more sanitary working conditions.

Throughout the 40's and 50's, production of asbestos based products continued, with the greatest exposure to workers probably during these years. A rough estimate suggests that upwards of 5 million workers and members of their immediate family might have been exposed over this period. A significant number of merchant seamen and dock workers were exposed in naval shipyards during the war years.

The Dreesen study in 1938 recommended that exposure should be limited to 5 millions of particles of dust per cubic foot (or 185 particles per cubic centimetre) in any one year, but emphasised that more research was needed. This level remained the benchmark until the late 60's, although it was not strongly enforced.

The first recognised definitive study of the harmful effects of asbestos was the Selikoff study in 1964, which established that the then widely accepted level of exposure to asbestos fibres was injurious. After the publication of this report, it became normal for asbestos producers to issue protective clothing and health advice to asbestos workers, although it is debatable how widely this wisdom was applied. This somewhat lax approach was the result of the more or less self regulating nature of US companies until the passage of the Federal Occupational Safety and Health Act in 1970. In 1971, the first mandatory exposure limits were imposed at 12 fibres per cubic centimetre, falling to 0.2 fibres per cc over the next 10 years.

The increased awareness of asbestos related diseases is partly attributable to the background of generally improving public health and in particular the almost complete eradication of tuberculosis after the introduction of streptomycin and BCG innoculations in the late 40s and early 50s.

As more became known about the harmful effects of asbestos, its apparent carcinogenic properties, and of course the sheer scale and economic cost potential of the problem, so the legal process developed. Claims for damages under workmen's compensation schemes increased and there was a growing realisation that substantial claims might be made under the products liability sections of producers' CGL insurance policies, with the potential for very substantial punitive damages.

It was also during this period that the first major wave of the asbestos workers exposed during the 40s and 50s were showing signs of pulmonary injury, so heightening awareness in the public eye. Claims for bodily injury damages from these workers really hit the US around 1980, and by 1982 there were at least two major asbestos products producers filing for bankruptcy, namely Johns Manville and UNR Industries of Chicago.

The first major wave of bodily injury claims hit the London market around 1982. The delay in recognition of claims in the London Market and in Europe is due to the fact that the London Market is mainly an excess and reinsurance carrier and to legal process and establishment of guiding philosophies and legal theories of trigger of coverage and number of claims. The different definitions and interpretations possible affect the primary insurers, excess insurers and reinsurers differently.

The latest major legal development has been the AHERA (Asbestos Hazard Emergency Response Act) legislation affecting asbestos in property. Essentially it mandates the removal of friable asbestos from schools. There is at present no statutory requirement to remove asbestos from other types of buildings, although the EPA were required to survey all public and municipal buildings. However, some buildings owners have voluntarily removed asbestos and are claiming compensation from the producers, or, in some cases, the architects. The legal position of this issue is not generally crystallised, but the potential could exceed that experienced for injury claims.

There is no sign of any reduction in the filing of new bodily injury claims which currently run at about 2000 a month. The principal occupations currently involved in litigation are:-

1. Shipyard workers
2. Insulation workers
3. Construction workers
4. Tyre workers
5. Railway workers (claiming against their employers under the FELA legislation)
6. Steel workers

Items 4-6 are relatively new groups.

It has been estimated that there were over 13 million workers and families exposed to asbestos between 1940 and 1980 (Dr I G Selikoff), and that about 9 million of these were still alive in 1981.

APPENDIX IV

Reserving for Asbestos Related Claims

Introduction

This note describes an approach being used by one London Market Company to estimate the ultimate cost of US product liability asbestos related claims. The US situation is unique in 2 respects:

1. The ease with which injured parties can obtain compensation

2. The fact that employees are claiming against the producers of asbestos or asbestos containing materials, rather than their employers.

Those employees subject to the Federal Employers Liability Act (FELA) are in fact claiming from their employers, as these claims are not subject to the same limits that apply to other workers' compensation claims.

The Approach

Because the bulk of the claims are being made as product liability claims against the asbestos producers, they are being made under a section of the policy which is normally subject to an aggregate limit for all product related claims in a given year of insurance. We can use this feature of the insurance coverage to estimate the maximum loss to the insurance company. There are, however, a number of other features which complicate the picture:

1. Most primary policies and some excess layer and reinsurance policies specify their limits in terms of the amounts paid in compensation to third parties. Amounts paid to defend the insured against those underlying claims are often in addition to those policy limits, and are not subject to any independent limit.

2. Normally these defence expenses will cease on exhaustion of the indemnity limit, but before 1966 the primary policy may have an unlimited duty to defend.

3. Many of these claims date back very many years, and the insurer may not have complete records of all of the policies issued in the early years. In some cases the current generation of management discovers the existence of an old policy only on receipt of a claim notification against it.

4. At the reinsurance level, even if the reinsurer has complete records of the treaties and facultative policies that he issued, he is still dependent on his cedant's advising him which direct policies the cedant has issued.

5. In the LMX market, it is often impossible to trace the full chain of retrocession, reinsurance and insurance down to the original producer.

6. Many old reinsurance and LMX policies provided free and unlimited reinstatements, so there is no theoretical upper limit to the potential liability, although there is a limit for any one loss (or any one original insured if the Treaty has an aggregate extension clause).

7. At the reinsurance level, there can be uncertainty about whether bodily injury and property damage claims should be aggregated and set against one policy limit, or whether they constitute two separate types of claim for which the reinsurer must provide 2 separate limits.

Implementation

1. A new computer system was written to record details of policies and treaties exposed to asbestos claims. This provides for information beyond that required for the normal computer system, and caters for policies issued prior to the introduction of the existing computer systems.

2. Details of identified policies and treaties were entered on this new database.

3. In the case of reinsurance treaties, details were requested from the cedant of the limits, deductibles and certain conditions of their original policy. This information was entered on the new computer system so that information about both direct insurance and reinsurance could be assembled for any given original insured (asbestos producer).

4. When a claim was notified which identified the existence of a policy not previously recorded, enquiries were made about whether that policy had been renewed from previous years, or continued into subsequent years. In addition, enquiries were made about whether higher layer excess policies were written for the same insured or for the same cedant. In this way information about the exposures written was extended ahead of the notification of claims.

5. The maximum limit of liability for any given contract was assessed by reference to the policy limit, or, in the case of reinsurance, by reference to the limits of the policies written by the cedants.

6. In the case of LMX, the assumption was made that most major producers would eventually give rise to a total loss to the LMX contract, but that in general the LMX contract would sit high enough in the reinsurance programme that minor producers would not produce claims large enough to penetrate that level. An estimate was made of the number of major producers expected to penetrate to the level of reinsurance concerned.

7. The producers against whom claims were notified were classified into 3 bands, depending on their perceived potential for further claims. The top band was clearly the major producers who feature in so much asbestos litigation.

8. This information was summarised by type of producer, type of claim (BI or PD), type of policy and year, and the resulting exposures compared with the paid and reported claims cost to date.

9. Both exposure and claims information were passed through the reinsurance programme to generate equivalent net exposures and claims figures.

10. Judgement was then exercised, in the light of this information, about whether all of the exposures in the category concerned would ultimately become fully burned, or whether the claims would stop developing at some stage intermediate between the present reported loss and the ultimate maximum loss.

11. The rate of development of reported losses within each category is then monitored to see whether the rate of progression is consistent with the assumed level of the asymptote.

12. In the case of LMX, the number of producers generating claims under the LMX treaty is also monitored to see whether the rate of development is consistent with the number of total loss claims being assumed in the ultimate estimate.

13. In addition, the rate at which new exposures are revealed by the notification of new claims is also monitored to see whether the company's information about exposures is reasonably complete, and, if not, an estimate is made of how much additional exposure may come to light.

Conclusion

It is felt that this information base and form of analysis provides a framework within which estimates can be made of the ultimate cost of claims in this portfolio, and those estimates compared with the emerging development of claims costs to assess the reasonableness of the assumptions being made. It is felt that this approach could be adapted for use in other areas of claim reserving which are not susceptible to traditional triangulation methods.

APPENDIX V

U.S. Pollution Litigation Issues - Description

Introduction

This appendix describes our understanding of the key issues affecting pollution claims. We specifically refrain from comment on the merits of the arguments described.

The Key Issues

A. Coverage Defences

Insurers maintain that most types of pollution claims are not covered, and do not give rise to a duty to defend. The main arguments are these:-

1. "Damages" (Property Damage)

   Insurers maintain that CERCLA response costs are not "damages" within the meaning of the CGL policy, and hence neither indemnity nor the duty to defend is triggered. A variant of this coverage defence is that the liabilities insured are not because of "property damage" as defined in the policy. This defence is based largely on the particular provisions of CERCLA, which gives three remedies:
   a) Injunction (the EPA instructs the PRP to clean up);
   b) The EPA can commission clean-up directly, using Superfund, and seeks recovery from the PRP;
   c) Bodies other than the EPA can claim against the PRP for damage to the environment.

2. "No Suit"

   Without prejudice to the above argument, insurers also maintain that a PRP letter or similar request to clean up a hazardous waste site does not constitute a "suit" and hence does not trigger the duty to defend.

3. "Occurrence" ("Expected or Intended")

   In most pollution cases we are dealing with intended acts, although it is claimed that unexpected and unintended consequences of deliberate acts are covered. However, in some situations insurers believe that the consequences were not unexpected or unintended. This coverage defence can apply to any kind of claim, not only clean up costs.

4. Own Property Exclusion

In many cases insurers maintain that the property alleged to be damaged is owned by, or in the control of, the insured, and hence is not covered by a CGL policy. However, some courts have expressed the view that groundwater is communal property, not owned by the landowner, and some maintain that clean-up required to prevent further migration of toxic materials or contamination of water supplies is covered by a CGL policy.

NOTE

The following coverage defences are specific to the wording or circumstances of a particular policy. They deny coverage for a specific policy, but not necessarily for all policies.

5. Pollution Exclusion

These clauses were an attempt to clarify and make specific the insurers' general contention that improper storage or disposal are uninsurable business risks, whereas genuine accidental spills or bursts are legitimate claims. There are several variants of the pollution exclusion clause. The two main standards are the I.S.O. (U.S market) and N.M.A. (London market). They were introduced in the early '70s.

6. New (or Absolute) Pollution Exclusion

Some courts held that the pollution exclusion was ambiguous or ineffective, and this led insurers to exclude all pollution claims in the absolute pollution exclusion. This was introduced in the early '80s.

8. Known Loss (Loss in Progress)

Insurers contend that policies which begin after the loss has been discovered do not insure that loss, on the grounds that you cannot insure a burning building.

8. "Personal Injury"

"Personal Injury" is an optional extension to a standard CGL policy, and one in fairly frequent use. Insureds whose policies include that extension maintain that it can provide coverage for "environmental" or "toxic tort" claims.

The main planks of their argument run as follows:

a) The pollution exclusion does not apply to the personal injury extension.

b) The coverage is based on an "offence" rather than an "occurrence" and hence the "expected or intended" defence is irrelevant.

c) Many of the complaints against the insured allege offences such as trespass or nuisance, which the insureds argue are covered by the extension.

d) The insurer has a duty to defend, even if the allegations are false or fraudulent.

C. Allocation Issues

In the event that coverage does apply to a particular claim, there are a number of issues which affect how the loss is allocated between the various parties involved: insured, primary insurer, umbrella (excess layer) insurer; and reinsurers.

1. Number of Claims

The question of what constitutes one claim depends entirely on the facts of each case, and can be very hard to determine. However the number of claims determines the number of self-insured retentions (SIRs) the insured has to bear, the number of policy limits the insurer may have to pay, and the stage at which excess carriers and reinsurers are called into play. This issue interacts with the others below.

2. Trigger of Coverage

Most situations giving rise to pollution claims are not sudden events, limited in time and space, but ongoing processes covering many years. In such situations we need to decide which, if any, periods of coverage are triggered. There are three common theories:-

a) Manifestation - only the policy in force at the time the occurrence is first discovered is triggered.

b) Injury-in-Fact - an attempt is made to determine when actual physical injury or damage is done, and all policies in force at those times are triggered.

c) Exposure - all policies in force during the operations giving rise to the claim are triggered.

3. Stacking (Spreading)

If a continuously operating occurrence is deemed to trigger more than one policy period, can the insured claim up to the full policy limit from each policy, or is he restricted to one limit for one occurrence? The "Keene" decision treated asbestos bodily injury as a continuing occurrence triggering all policies from first exposure to manifestation, and the insured could elect which policies should respond.

D. Additional Excess Layer Issues

1. Exhaustion by Layers or Years

Where there are multiple claims on multiple years of cover, the choices open to the insured can exhaust one year's primary cover before the others. In this case, can the insured recover subsequent claims from the excess layer policy (exhaustion by year) or must he select unexhausted primary cover years first (exhaustion by layer)? Decisions on this issue are split.

2. Duty to Defend

Unless explicitly excluded, excess carriers are usually not required to pay defence costs until the underlying layer has been exhausted. After 1966, policy wordings usually made it clear that duty to defend expires on exhaustion of indemnity limits.

3. "Drop Down"

Depending on the exact policy wording (and the jurisdiction) an excess layer direct insurer may be required to "drop down" and take the place of an insolvent primary or lower layer insurer.

4. Good Faith

Many courts hold that the insured and the primary insurer both owe a duty of good faith to the excess carrier.

5. Settlements below Primary Limits

In normal circumstances, an excess layer (umbrella) insurer could not be called upon to pay until the primary insurer had paid his policy limit. However, where there are coverage disputes affecting large claims, the insured may agree to accept less than the full policy limit in settlement rather than litigate the dispute. In these circumstances, excess layer insurers may argue that the insured has no claim against them, since he has not exhausted his primary coverage. The insured will clearly argue the converse.

E. Additional Reinsurance Issues

1. Site Clause

Some cedants are trying to aggregate all their losses at one toxic waste site, from several different insureds, on the basis of the Site Clause in the reinsurance wording. This basis of aggregation is currently being contested, and as most reinsurance policies have an arbitration clause, it should be decided in arbitration.

2. Late Notice/Adequate Notice/Update

Normally, late notice relieves the reinsurer's obligation to indemnify. In some States prejudice need not be shown.

3. "Follow the Fortunes"

Reinsurers are normally bound by a good faith settlement pursuant to the underlying contract. However the reinsurer need not pay if there is no coverage or where the settlement exceeds the reinsurance limit. The key features are:
REASONABLE, COMPETENT, GOOD FAITH.

Reinsurers may be required to follow intent rather than language.

Self-insurance can be included as "underlying insurance".

4. DJA Costs

There is disagreement about whether DJA costs can properly be regarded as claims expenses by cedants. (DJAs, Declaratory Judgement Actions, are lawsuits between insured and insurer to resolve disputes about policy coverage).

APPENDIX VI

Environmental Pollution Reserving Example

Data

The data were available gross of excess of loss reinsurance but net of proportional reinsurance. Allowance for excess of loss recoveries is made separately. Summaries of paid and outstanding claims data by insured and year when any site was first notified by the insured were also available.

Methodology and Results

Projections of claims from insureds, who have already notified sites, were made using a link ratio approach. Claims arising from ABC Corporation are considered exceptional and not representative of expected future notifications. As a result, claims from this source are projected separately. The results of the projections are summarised in Table 1 below.

TABLE 1

	Outstandings as at 31st December 1989	Projected ultimate future claims for insureds with claims notified as at 31st December 1989
	$000s	$000s
ABC Corporation	7,311	10,553
Other insureds	5,631	7,741
Total	12,942	18,294

In order to make allowance for new insureds notifying claims, the following pattern of recent years' notifications (including ABC Corporation) was considered:

Year	1984	1985	1986	1987	1988	1989	Total
Number of New insureds notifying claims	3	2	5	6	12	11	39

It is not obvious how to project this pattern into future years. However, a reasonable projection is considered to be based on a further 10 years notifications at the level of the average of the four most recent years. The average number of insureds notifying over 1986 to 1989 is 8.5 per year. Ten years at this level gives a total of 85 new insureds.

Excluding ABC Corporation the total projected ultimate claims cost for insureds with claims notified is $380,000 (paid) + $7,741,000 (future payments) = $8,121,000. Thus the average ultimate cost is $8,121,000/38 = $214,000 per insured. The reserve for claims from new notifications is therefore 85 X $214,000 = $18,190,000. This gives results as summarised in Table 2 below.

TABLE 2

Estimated Reserve Gross of Excess of Loss Recoveries

	$000s
ABC Corporation	10,553
Other known insureds	7,741
IBNR	18,190
Total	36,484

Excess of Loss Reinsurance Reserves

The reinsurers who provided excess of loss cover are currently not accepting any liability for pollution claims. If UK courts adopt the opposite position from that currently being adopted in the USA then the insurer will be liable for the gross claims. Table 3 below shows the potential excess of loss recoveries ("PXLR") based on outstanding claims as at 31st December 1989.

TABLE 3

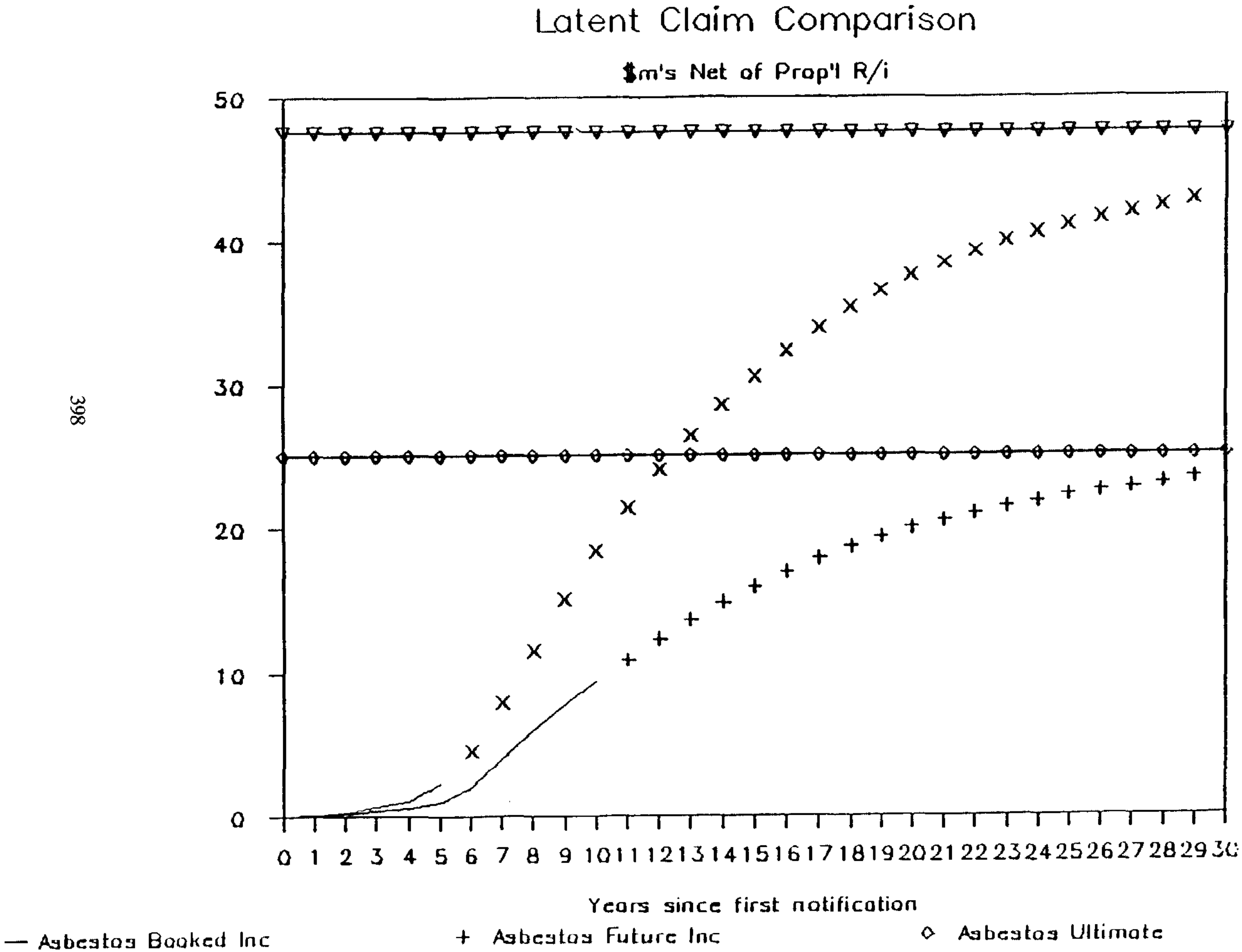
	Gross of PXLR	Net of PXLR	Potential Percentage Recoverable
	$000s	$000s	%
ABC Corporation	7,311	2,299	69
Other insureds	5,631	3,439	39
Total	12,942	5,738	56

Table 4 below shows the reserves net of excess of loss recoveries assuming the potential percentages recoverable apply to all reserves. There are a number of reasons why it is unlikely that all potential recoveries will be made. As a result figures assuming only 50% of potential excess of loss recoveries are realised are also shown.

TABLE 4

Reserves as at 31st December 1989

	Gross of PXLR	Percentage PXLR	Net of all PXLR	Net of 50% of PXLR
	$000s	%	$000s	$000s
ABC Corporation	10,553	69	3,271	6,912
Other known insureds	7,741	39	4,722	6,232
IBNR	18,190	39	11,096	14,643
Total	36,484	48	19,089	27,787



APPENDIX VII

APPENDIX VIII

Pollution Scenario

This note has been prepared for private study only, to help develop and test our understanding of the issues and their implications. The style is deliberately flippant to discourage any other use.

Dumper Manufacturing Inc. deposited toxic waste at Isore Toxic Waste Site between 1966 and 1980. They have been served with an EPA notice, which says they have a 15% share of the cost of clean-up, estimated at $100M.

Obviously this is not covered. We know it is not covered, the insurers know it is not covered and Dumper knows it is not covered. However, a $15M bill will sink Dumper, so they have to try anyway, in the hope they can find a smart lawyer. Fortunately for Dumper, they are based in New Jersey, which has more than its share.

Dumper's coverage profile from 1966 to 80 is as follows:

$000's

Years of Cover	Primary Limit	First X/S LIM DED	Second X/S LIM DED	Third X/S LIM DED	Poll Excl Clause
1966-1970	750	1250/750	3000/2000	5000/5000	NONE
1971-1975	1000	1500/1000	5000/2500	7500/7500	ISO
1976-1980	1500	2500/1500	6000/4000	10,000/10,000	ABSOLUTE

One approach to reserving might be to spread the total cost uniformly over all potentially exposed policies. This gives:

$750,000 for the 1966-70 primary policies
$250,000 for the 1966-70 first excess policies
$1M for the 1971- 80 primary policies

However, insurers will seek to convince the court that clean-up is not covered, using any or all of the following defences:

Damages
No Suit
Property Damage
Expected or Intended

The consensus is that even in New Jersey, there is only a 1 in 4 chance of the court overturning the clear intention of the policy and finding cover. The insurers therefore expect to make no payment 3 times out of 4. However, on the 4th occasion, we need to consider what the costs might be.

Let us assume the absolute pollution exclusion will always hold, but that the chances of the ISO exclusion being upheld in New Jersey are only 50:50. Thus the 1976-80 insurers will reduce their reserves to nil, whereas the 1971-75 insurers assess their chances of paying at 1 in 8.

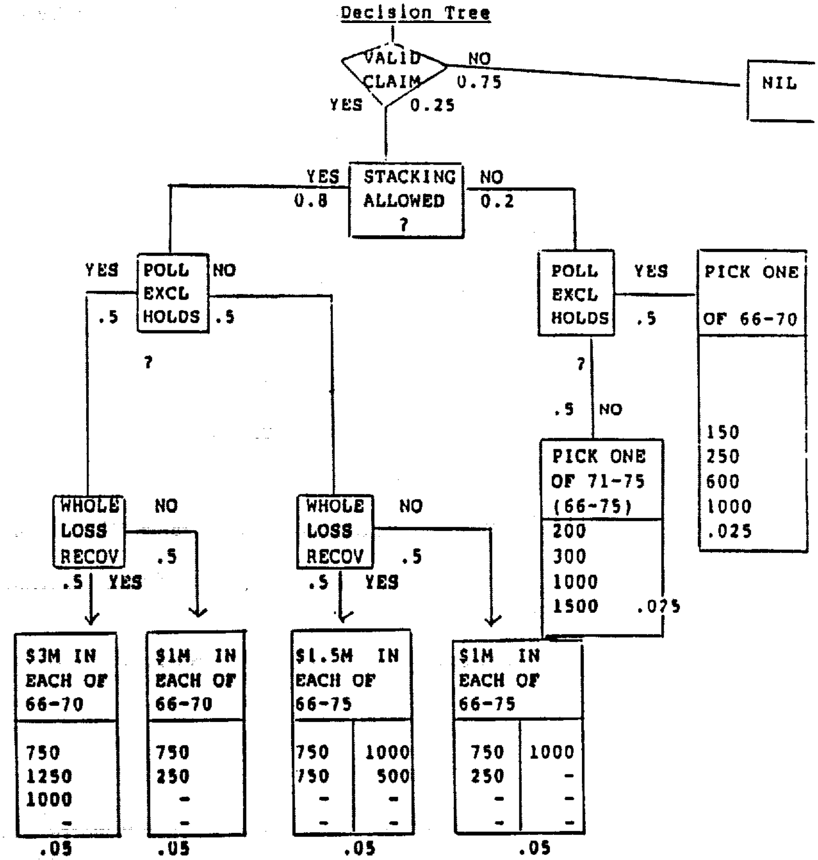
The next most important question is stacking. If stacking is not permitted then Dumper can only have the benefit of one year of cover. If the ISO exclusion is upheld, this means they will not have enough cover. In any event, under this scenario, any policy selected will suffer a total loss. We assess the chances of stacking being allowed at 0.8.

If stacking is permitted, we next need to ask whether Dumper can recover the whole loss, or whether the courts will require them to meet the costs which would have been borne by the later policies in the absence of the exclusion clauses. We have no idea about this, so we guess a 50:50 chance. For this purpose, too, we assume the court will adopt a continuous trigger theory.

If Dumper has to stand in place of excluded insurers, we have the uniform spreading approach suggested above. If not, then the whole loss will be spread over the 5 or 10 triggered policies.

We can now work out the consequences on each policy:

Decision Tree



LAYER	EXPECTED PAYMENTS $000s 66-70 (ATT)	71-75 (ATT)
	-----	-----
PRIMARY	153.75 (750)	105 (1000)
FIRST X/S	131.25 (250)	32.5 (-)
2ND X/S	65.0 (-)	25 (-)
3RD X/S	25.0 (-)	37.5 (-)
	-------	-------
	375.0 (1000)	200.0 (1000)
	-------	-------

TOTAL EXPECTED CLAIM = 375 x5 = $1.875M FROM 1966-70 POLICIES
PLUS 200 x5 = $1M FROM · 1971-75 POLICIES
= $2.875M

The numbers beneath each box are the probabilities, which do indee add up to 1!

APPENDIX IX

Some Potential Sources of Information

Environmental Claims Group

Environmental Claims Reinsurance Group

Asbestos Working Party

Ad Hoc Railroad Committee

Loss Prevention Council

Institute of Occupational Medicine

Health and Safety Executive of the Department of Employment

Topliss and Harding (Market Services) Ltd

National Council on Compensation Insurance (New York)

Encyclopedia of Occupational Health and Safety (International Labour Office, Geneva)

The Pocket Guide to Chemical Hazards (US Department of Labour)

Brokers

Note that these references are given as sources where information is known to exist. However no guarantee is given of the east with which the organisations concerned ca be persuaded to part with their data!

APPENDIX :

LATENT CLAIMS

SURVEY OF DEVELOPMENTS AND RESERVING PRACTICES IN THE NON-LIFE INSURANCE INDUSTRY

A survey of developments and reserving practices in the non-life insurance industry, in respect of latent claims, was distributed to 276 insurers in the UK, including composites, specialist general insurers and reinsurers, London Market companies, and Lloyd's Managing Agents. By the middle of August 1990, 67 responses had been received, of which 50 indicated a significant exposure to latent claims. The results of these responses are summarised in the following pages.

It should be noted that, in some instances, the interpretations given to particular questions appear to have varied between respondents and, therefore, the results, as summarised, may be distorted.

QUESTION 1

Do you believe that you have, or have had, any significant exposure to the following latent claims?

RESULTS

	%
Agent Orange	37
Asbestos (Bodily Injury)	64
Other Lung Diseases	27
Asbestos (Building Claims)	48
Dalkon Shield (IUD)	22
Deafness	45
DES	40
Pollution	61
Spondylosis	3
Tenosynivitis (ULD, RSI)	10
Vibration White Finger	15
Other - *please specify*	12

These results have been derived as percentages of respondents replying.

Other latent claim types specified included:-

- Bone Necrosis
- Brucellosis
- DDT
- Dermatitis
- Tunnel Syndrome
- Lead exposure

OBSERVATIONS

- 25% of respondents have, or have had, no significant exposure to latent claims of any type. In most instances the reason for this was that the respondent only started underwriting in the 1980's.
- Of those respondents with significant exposure to latent claims, 82% have exposure to Pollution claims and 86% have exposure to Asbestos (Bodily Injury) claims.

QUESTION 2

What impact have these latent claims had to date on each area of your business?

A *Significant*
B *Moderate*
C *Modest*

RESULTS

	A %	B %	C %
Direct Business			
Liability	57	10	33
Property	12	29	59
Marine	25	42	33
Aviation	38	31	31
Reinsurance Business			
Liability	59	6	35
Property	5	26	69
Marine	12	24	64
Aviation	23	8	69

For each business area the figures have been derived as percentages of respondents indicating an impact in that business area.

OBSERVATIONS

- The business area where the impact of latent claims has been most significant is for Liability on both Direct and Reinsurance business.
- All areas of business have been impacted to some degree by latent claims. Apart from Liability an Direct Marine business, respondents have generally assessed the impact of latent claims to be modest.
- The impact of latent claims on Liability and Property accounts has been very similar for both Direct and Reinsurance business.

QUESTION 3

Do you produce separate statistical information for these claim sources?

RESULTS

	%
Agent Orange	64
Asbestos (Bodily Injury)	77
Other Lung Diseases	33
Asbestos (Building Claims)	78
Dalkon Shield (IUD)	53
Deafness	50
DES	67
Pollution	80
Spondylosis	50
Tenosynivitis (ULD, RSI)	71
Vibration White Finger	50
Other	63

For each latent claim type the results have been derived as percentages of respondents with significant exposure to that claim source.

OBSERVATIONS

- The use of statistical information for Asbestos and Pollution claims is widespread. The figure for Tenosynivitis (ULD, RSI) is based on a sample which is not statistically credible.
- Only a few respondents hold separate statistical information for claim sources for which they have not identified a significant exposure.

QUESTION 4

How are claims allocated by underwriting/accident year within your database?

- *A* *To the year of reporting.*
- *B* *On a time apportionment basis, spread over a number of underwriting/accident years.*
- *C* *Where a period of exposure is involved: to the earliest underwriting/accident year in this period.*
- *D* *Where a period of exposure is involved: to the latest underwriting/accident year in this period.*
- *E* *As specified in the claim notification.*
- *F* *Other - please specify.*

RESULTS

	A %	B %	C %	D %	E %	F %
Agent Orange	4	26	4	0	70	4
Asbestos (Bodily Injury)	10	36	12	2	55	2
Other Lung Diseases	16	21	16	11	47	0
Asbestos (Building Claims)	6	39	6	3	55	3
Dalkon Shield (IUD)	6	22	6	0	67	11
Deafness	10	32	10	6	52	0
DES	7	32	4	0	68	4
Pollution	7	41	9	2	59	5
Spondylosis	17	17	17	0	67	0
Tenosynivitis (ULD, RSI)	33	11	11	11	56	0
Vibration White Finger	25	25	17	8	42	0
Other - *please specify*	30	10	20	20	30	0

For each latent claim type the results have been derived as percentages of respondents replying to that part of the question. A number of respondents use more than one basis to allocate claims.

Other methods of allocating claims specified included:-

- by Attorney advices.

OBSERVATIONS

- The most common method of allocating claims within respondents' databases is "as specified in claim notifications". This may, however, suggest that the majority of respondents are London Market organisations (as opposed to Direct writers).

QUESTION 5

Which underwriting/accident years have been impacted by these claims?

RESULTS

	Prior Years	1950-1954	1955-1959	1960-1964	1965-1969	1970-1974	1975-1979	1980-1984	1985-1989
	%	%	%	%	%	%	%	%	%
Agent Orange	0	4	4	61	74	61	26	9	0
Asbestos (Bodily Injury)	38	50	53	65	75	65	73	70	23
Other Lung Diseases	25	50	42	58	75	83	67	42	33
Asbestos (Building Claims)	24	38	38	55	66	62	66	66	17
Dalkon Shield (IUD)	0	0	0	9	9	91	100	0	0
Deafness	23	31	46	62	73	69	62	58	38
DES	19	50	62	77	85	62	35	15	0
Pollution	25	45	55	63	68	68	78	80	53
Spondylosis	100	100	100	100	100	100	100	100	100
Tenosynivitis (ULD, RSI)	17	17	17	17	33	33	33	83	100
Vibration White Finger	11	11	11	22	22	56	67	33	67
Other	33	50	50	50	33	33	33	83	67

For each period and each latent claim type the results have been derived as percentages of respondents indicating an impact from that claim source. Many respondents have claims impacting more than one group of underwriting/accident years.

OBSERVATIONS

- The development on the most recent underwriting/accident years is likely to be relatively immature and therefore percentage impacts may be understated.

- It should be noted that the distribution of claims indicated above does not allow for the quantum of claim notifications, it only allows for the existence of claim notifications.

- The 1960-1974 underwriting/accident year period involves the heaviest impact to latent claims. This may, however, be a function of the underwriting history of the various respondents.

- All latent claims have impacted across all underwriting/accident years except for the following:-

  - Agent Orange: impacts underwriting/accident years 1950-1984 only and only one respondent indicated exposure in the period 1950-1959;
  - Dalkon Shield (IUD): impacts underwriting/accident years 1960-1979 only;
  - DES: does not impact underwriting/accident years 1985-1989.

- The experience of respondents impacted by Asbestos and Other Lung Diseases claims shows some indication of the impact of tighter underwriting controls and safety awareness in more recent years

- For those respondents impacted by Pollution claims, the periods of exposure to such claims appear to be significant from the 1950's.

- Of the respondents affected by Tenosynivitis (ULD, RSI) and Vibration White Finger claims, the impact of such claims has been concentrated on underwriting/accident years 1980-89 and 1970-89, respectively.

QUESTION 6

When were claim notifications first received?

RESULTS

	Prior Years	1950-1954	1955-1959	1960-1964	1965-1969	1970-1974	1975-1979	1980-1984	1985-1989
	%	%	%	%	%	%	%	%	%
Agent Orange	0	0	0	0	0	0	30	70	0
Asbestos (Bodily Injury)	3	0	3	0	0	3	23	65	3
Other Lung Diseases	8	0	15	0	0	8	15	31	23
Asbestos (Building Claims)	0	0	0	0	0	0	4	42	54
Dalkon Shield (IUD)	0	0	0	0	0	0	80	20	0
Deafness	5	0	5	0	0	0	9	29	52
DES	0	0	0	0	0	11	47	31	11
Pollution	3	0	0	0	0	0	8	50	39
Spondylosis	0	0	0	0	0	0	0	0	100
Tenosynivitis (ULD, RSI)	0	0	0	0	0	0	17	17	66
Vibration White Finger	0	0	0	0	0	0	14	14	72
Other	0	0	0	0	0	0	25	50	25

For each latent claim type the figures have been derived as percentages of respondents impacted by that claim source. Some respondents were unable to provide information for this question and their responses have been excluded.

OBSERVATIONS

- Claim notifications, for most latent claim sources, were first received in the period 1975-1979.
- Respondents generally received initial claim notifications for Asbestos (Bodily Injury) claims in the period 1980-1984 and for Asbestos (Building Claims) in the period 1985-1989.
- The majority of initial notifications for industrial disease type claims have been received in the period 1985-1989.
- Initial notifications for product-related claims appear to be concentrated in a ten year period (this classification would include Asbestos (Bodily Injury)) whereas initial industrial disease claim notifications appear to be spread over a wider period.

QUESTION 7

Is the incremental incurred (paid plus outstanding excluding IBNR) development of such claims:-

A *Accelerating?*
B *Decelerating?*
C *Stable?*

RESULTS

	A %	B %	C %
Agent Orange	8	33	59
Asbestos (Bodily Injury)	51	13	36
Other Lung Diseases	47	15	38
Asbestos (Building Claims)	64	3	33
Dalkon Shield (IUD)	7	29	64
Deafness	74	4	22
DES	27	19	54
Pollution	94	3	3
Spondylosis	0	0	100
Tenosynivitis (ULD, RSI)	50	17	33
Vibration White Finger	63	12	25
Other	80	0	20

For each latent claim type the results have been derived as percentages of respondents indicating a response to that part of the question.

OBSERVATIONS

- Almost all respondents impacted by Pollution claims are experiencing accelerating incremental incurred development of such claims.
- Asbestos (Building Claims) and Deafness claims are the other main latent claim sources where the majority of respondents are experiencing accelerating incremental incurred development.
- The results in many instances, eg largely stable development for Agent Orange, Dalkon Shield and DES, are surprising. This may suggest a misinterpretation of the meaning of stable incremental development.

QUESTION 8

Do you analyse the development of latent claims by:-

A Underwriting/accident year?
B Calendar year of reporting?
C Underwriting/accident year and calendar year of reporting?

RESULTS

	A %	B %	C %
Agent Orange	62	5	33
Asbestos (Bodily Injury)	57	5	41
Other Lung Diseases	38	15	47
Asbestos (Building Claims)	52	4	44
Dalkon Shield (IUD)	69	0	31
Deafness	57	8	35
DES	55	4	41
Pollution	62	3	41
Spondylosis	0	0	100
Tenosynivitis (ULD, RSI)	17	33	50
Vibration White Finger	43	14	43
Other	20	20	60

For each latent claim type the results have been derived as percentages of respondents indicating a response to that part of the question.

OBSERVATIONS

- The majority of respondents use underwriting/accident year analyses and, of these, a high proportion analyse development by calendar year of reporting. Very few respondents use solely calendar year of reporting in order to analyse the development of latent claims.

QUESTION 9

How do you reserve for known outstanding claims?

A *Legal fees only.*
B *Attorney's advised reserves.*
C *Cedant's advised reserves.*
D *Percentage of exposure.*
E *Other - please specify.*

RESULTS

	A %	B %	C %	D %	E %
Agent Orange	8	75	42	4	17
Asbestos (Bodily Injury)	5	64	44	8	23
Other Lung Diseases	6	56	13	19	38
Asbestos (Building Claims)	10	71	35	10	19
Dalkon Shield (IUD)	14	79	50	7	21
Deafness	3	55	23	13	29
DES	4	80	40	4	20
Pollution	8	70	40	15	13
Spondylosis	100	100	100	0	0
Tenosynivitis (ULD, RSI)	20	20	20	20	60
Vibration White Finger	13	25	25	38	50
Other	0	17	17	17	67
All Latent Claims combined	0	40	20	20	20

For each latent claim type the results have been derived as percentages of respondents indicating a response to that part of the question. Some respondents use more than one method in reserving for known outstanding claims.

Other methods of reserving for known outstanding claims specified included:-

- Individual case estimates
- Underwriters reserves
- Loss adjusters advised reserves
- Statistical methods

OBSERVATIONS

- The most common method of reserving for known outstanding latent claims indicated is to make use of attorney's and/or cedant's advised reserves. This again might indicate a London Market bias within responses.

- The use of a percentage of exposure or legal fees only for reserving purposes is relatively uncommon.

QUESTION 10

Do you hold a specific IBNR reserve for these liabilities?

RESULTS

	%
Agent Orange	32
Asbestos (Bodily Injury)	56
Other Lung Diseases	28
Asbestos (Building Claims)	53
Dalkon Shield (IUD)	7
Deafness	20
DES	37
Pollution	63
Spondylosis	0
Tenosynivitis (ULD, RSI)	14
Vibration White Finger	20
Other	13
All Latent Claims combined	12

For each latent claim type the results have been derived as percentages of respondents with significant exposure to that claim source.

OBSERVATIONS

- Pollution and Asbestos claims are the only claim sources for which the majority of respondents hold specific IBNR reserves.
- 12% of respondents with significant exposure to latent claims hold an IBNR reserve for all latent claims combined.

QUESTION 11

If a specific IBNR reserve is held, what methods of calculation are used?

A *Analysis of claims amounts and reporting patterns.*
B *Percentage of known outstanding claims.*
C *Percentage of incurred claims.*
D *Percentage of written/earned premium.*
E *Hindsight on known IBNR subsequent to accounting period.*
F *Analysis of exposures.*
G *Other - please specify.*

RESULTS

	A %	B %	C %	D %	E %	F %	G %
Agent Orange	50	10	10	0	20	30	10
Asbestos (Bodily Injury)	46	17	21	0	13	33	13
Other Lung Diseases	50	0	0	0	0	50	13
Asbestos (Building Claims)	44	19	13	0	6	31	0
Dalkon Shield (IUD)	67	0	0	0	33	0	0
Deafness	50	10	0	0	0	50	20
DES	45	9	9	0	18	27	9
Pollution	36	20	24	0	16	36	12
Spondylosis	100	0	0	0	0	0	0
Tenosynivitis (ULD, RSI)	75	0	0	0	0	25	0
Vibration White Finger	67	0	0	0	0	50	33
Other	100	0	0	0	0	0	0
All Latent Claims combined	25	0	0	0	50	25	0

For each latent claim type the results have been derived as percentages of respondents indicating a response to that part of the question. Some respondents use more than one method of calculation.

Other methods of calculation specified included:-

- Analysis of specific risks
- Actuarial studies
- Statistical methods

OBSERVATIONS

- Respondents generally use an analysis of claim amounts and reporting patterns or an analysis of exposures in order to calculate IBNR reserves.

- No respondent calculates IBNR reserves based on a percentage of written/earned premium.

- For Asbestos and Pollution claims the variety of methods of calculation used is much greater than for other latent claims.

QUESTION 12

What proportion of overall outstanding liabilities does each latent claim source form?

Direct Business

A *Liability*
B *Property*
C *Marine*
D *Aviation*

Reinsurance Business

E *Liability*
F *Property*
G *Marine*
H *Aviation*

RESULTS

The interpretation placed on this question varies considerably among responses received and therefore th information available is not in a form suitable for analysis.

Market Bulletin

LLOYD

LLOYD'S OF LON

Telephone 01-623 7100. Facsimile 01-626 2389. Telex 987321 LLOYDS G

One Lime Street, London EC

APPENDIX XI

From: Manager, Taxation Department.

Extension: 5228

Date: 21 June 1990

Reference: TD/DRC/hrc/5490S

Subject: City 35 Review of Reinsurance to Close.

The purpose of this bulletin is to inform the Market of developments that are taking place in the way the tax legislation is implemented. I apologise tha it comes in the middle of the period for computation and submission of syndicate accounts and commentaries to the Revenue, but it was felt the Market should be informed of any significant development immediately rather than waiting until Account 1988.

1. Latent Claims

Concern has been voiced in the Market that the approach taken by City to the problems of certain latent claims, especially relating to asbesto and pollution, is not satisfactory. Pollution in particular is agreed to be a most difficult problem. This is not to imply that City 35 are acting unreasonably in any way; rather that existing mechanisms do not cater very well with these latent claims.

The background to the examination of syndicate accounts by the Inland Revenue is contained in what is now Section 450(5A) of ICTA 1988 and the Guidelines agreed between the Inland Revenue and Lloyd's. Both of these documents were attached to my Market bulletin dated 6th August 1987.

The crux of the problem is the emphasis within the Guidelines upon the need for statistical evidence that the elements of a syndicate's reinsurance to close fall within the legislation. The aforementioned Guidelines were not written with the problems of asbestos and pollution specifically in mind and it is becoming clear that, strictly interpreted by City 35, they could have resulted in disallowances substantially in excess of those which have been agreed. In practice City 35 have been flexible in the operation of the Guidelines and there are arguments for amending the guidelines so that syndicates have a better understanding how latent claims will be dealt with.

2. Extending the Guidelines

Discussions are currently taking place between Lloyd's and the Inland Revenue to revise the Guidelines to reflect the current, clearer, appreciation of the problems of latent claims. This is a process which will take some time but, in the meantime, City 35 have agreed to issue a statement concerning environmental pollution. This statement is attached as Appendix A and is of immediate effect.

As a result of the attached statement, Agents who have yet to submit their syndicate accounts to City 35 may wish to take its contents into account in their submissions. City 35 are anxious to continue to encourage early submissions of accounts and do not wish those who have already submitted accounts to be disadvantaged in any way. Therefore, Agents who have submitted accounts are invited to supplement their earlier submissions in the light of this statement if necessary.

3. Implications of the attached Statement

Neither the attached statement nor the Guidelines have any legal status, but they do show the approach City 35 will be taking to reviewing reinsurance to close. It is clear that City 35, when looking at the level of IBNR for environmental pollution claims, will take into account their knowledge of the issues involved and the nature of the syndicate's business. If this IBNR "looks high" at first sight, it is clear that they would expect there to be further supporting evidence.

The approach set out in the City 35 statement extends the scope of the evidence that the Revenue will consider beyond the narrower "statistical" approach implied in the Guidelines and is an approach which the Special or General Commissioners might take in the event that City 35 the Managing Agent failed to come to an agreement.

4. Input from the Market

We would welcome any suggestions or comments that you may have in respect of the guidelines, on any matters raised in this bulletin, or the Inland Revenue letter.

5. This bulletin is being sent out to all Managing Agencies and Recognised Auditors. Please telephone me on the above extension or Martin White or extension 6377 if you have any questions.

Yours sincerely,

R. Culliford

D R Culliford
Manager
Taxation Department

Introduction

1. I accept that as matters stand at present, Environmental Pollution is a particularly difficult subject which does not readily lend itself to statistical projection. There is, however, a growing body of evidence available to Underwriters and City 35 will wish to carefully weigh all the available information. The onus rests with the Underwriter to make his case and City 35 will consider whatever methodology is adopted and will carefully weigh all the evidence submitted by Underwriters in support of their Pollution reserves. The City 35 approach and the factors which we will typically take into consideration are set out in paragraphs 2-7 below but there may be other pertinent factors of which we are as yet unaware. I am not suggesting that there are not other approaches which are capable of satisfying the legislative test set out in Section 450 (5A) ICTA 1988.

Claims with Reserve Potentials

2. As in the past, City 35 will accept that the reserve potentials recommended by lawyers who have been instructed by Underwriters are a valid starting point in reviewing Pollution reserves for tax purposes. It is my understanding that the lawyers have attempted to adopt a consistent basis in setting reserve potentials. Reserve potentials differ from a conventional assessment of outstandings as there is no clear event or occurrence from which liability arises. Nor is account generally taken of the prospect of insurers being able to deny coverage to the assureds.

3. I believe that there are a number of coverage issues which may be contested in the Courts in establishing whether coverage exists under Comprehensive General Liability policies. For example the Court may consider whether the pollution was in some sense fortuitous; it may also consider whether the Superfund response costs should be widely construed as damages rather than as equitable relief; and it may also consider the effectiveness of any Pollution exclusion clause contained in the policy. The coverage cases currently progressing through the US Courts do not appear to reveal any clear and coherent pattern. On all the major coverage issues, some cases have been resolved in favour of insurers and some in favour of assureds. These coverage issues are therefore relevant factors to be weighed possibly on individual cases but more likely in the round in considering the extent to which reserve potentials are allowable for tax.

4. Despite coverage issues, other elements also need to be taken into account in considering cases on which reserve potentials have already been recommended, including the following:-

    i. Are clean up cost estimates likely to increase or decrease over time?

    ii. Is the US Government likely to indemnify defence contractors in respect of potential Superfund response costs?

    iii. Is the US Environmental Protection Agency (EPA) likely to accept offers in negotiated settlement with potentially responsible parties as an alternative to pursuing actions through the Courts?

iv. If coverage is established by an assured, then the question of the number of events or occurrences from which a loss arises may have a significant effect on the allocation of the loss between Primary and Excess Underwriters and reinsurers. The possibility that there may be no/multiple occurrences in each policy year per site rather than the occurrence scenario reflected in the reserve potentials will need to be considered and related to the nature of the business written by each individual syndicate.

Claims Without Reserve Potentials/Claims Not Reported

5. I recognise that there are notifications of claims where a lawyer has not been instructed following a preliminary consideration by the lead Underwriter. And in claims in which a lawyer has been instructed there is a time lag between the instruction and production of the report. I also recognise that the number of assureds who have made Pollution claims on their General Liability policies is likely to increase. In assessing the likely extent of increase on back years, regard must be had to matters such as possible increases in the number of sites on the US National Priority List (NPL), possible increases in the number of potentially responsible parties and the likely percentage of NPL sites at which no potentially responsible parties will be identified.

6. I think it is important to distinguish between the reinsurance of American domestic insurers and direct insurance. For a variety of reasons, notification to the London Market of Pollution claims by reassureds is lagging behind that by assureds. It therefore seems likely that there will be more comparative growth in the ECRG reports than in the ECG reports and this is a factor to which City 35 will attach weight. It would accordingly assist if Underwriters commentaries on Pollution were to be accompanied by schedules of reserve potentials for each year distinguishing (where the existing records have been maintained in such a form) between assureds and reassureds, indemnity and defence costs and show the affected layers in each case. If the existing records do not readily enable such detailed schedules to be produced for the 1987 Underwriting Account an alternative breakdown of reserve potentials in as much detail as possible without reconstructing claims records will generally suffice but it would be helpful if for 1988 and beyond detailed schedules could be produced as a matter of routine.

Reinsurance Credit

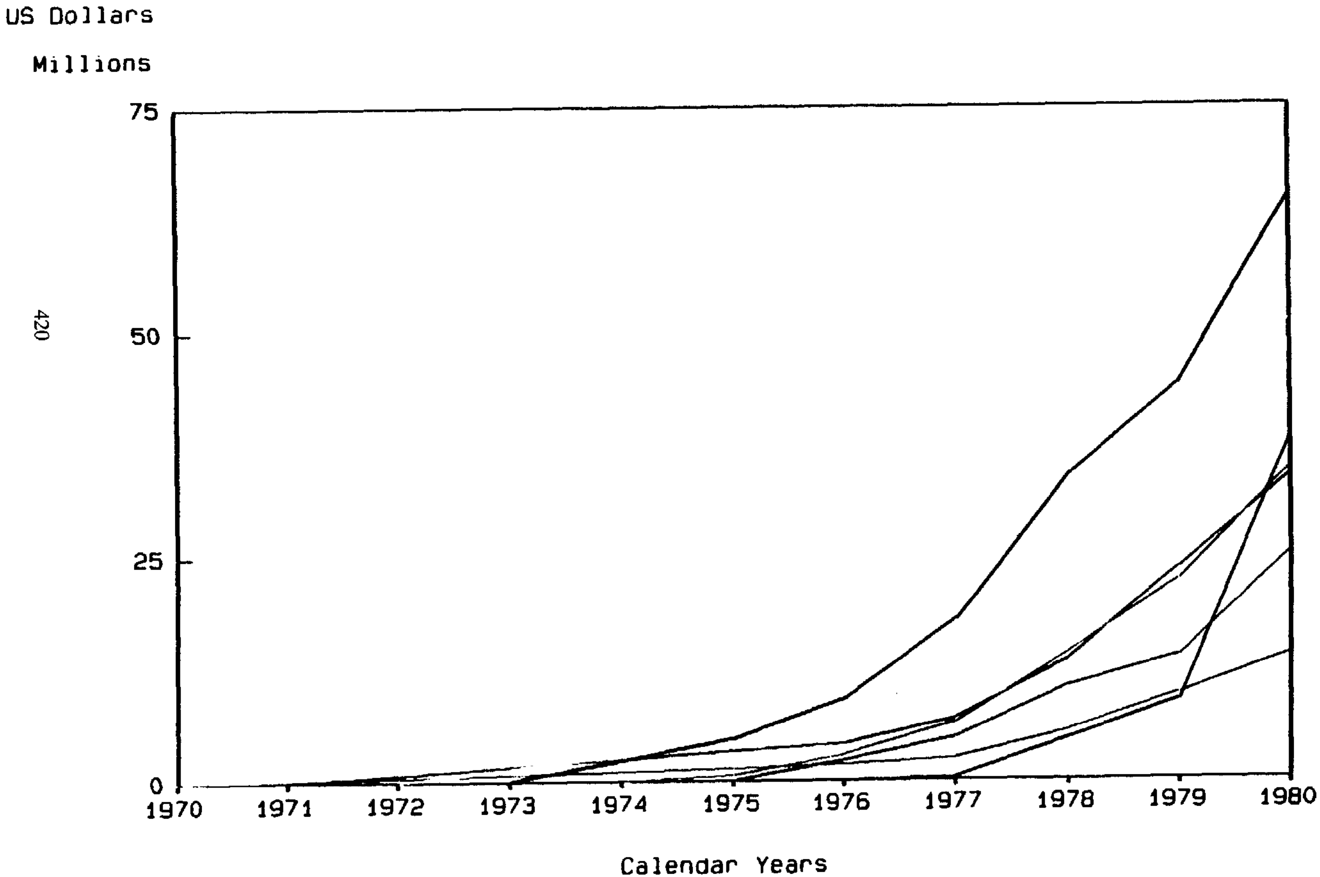
7. City 35 will address the question of whether any Excess of Loss reinsurance protections may be available to mitigate potential losses to each syndicate. It would therefore be helpful if Underwriters commentaries on Pollution were to clearly set out the basis, albeit under a reservation of rights, (e.g. a single occurrence or event per year, per site, per assured) upon which credit, if any, has been taken.

K. HAMER
HM Inspector of Taxes

[19 June 1990]

DALKON SHIELD - LONDON MARKET REINSURANCE

Claim Development Pattern by Year of Account



MORTGAGE–RELATED INSURANCES (79)
(GISG CONVENTION, 10/90)

Pecuniary Loss Working Party

GENERAL INSURANCE STUDY GROUP

MORTGAGE - RELATED INSURANCES

REPORT OF THE PECUNIARY LOSS WORKING PARTY

TO THE

GENERAL INSURANCE CONVENTION

NEWQUAY, 1990

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MORTGAGE-RELATED INSURANCES

REPORT OF THE PECUNIARY LOSS WORKING PARTY

SECTION A:

THE TRADITIONAL PRODUCT –

MORTGAGE INDEMNITY GUARANTEES

A. THE TRADITIONAL PRODUCT - MORTGAGE INDEMNITY GUARANTEE

1) Introduction

1.1 Actuarial involvement

Mortgage Indemnity Guarantee (MIG) Insurance is a class of business which appears to have received relatively little actuarial attention in the past, although it has been transacted for a considerable number of years. This lack of actuarial investigation may be associated with the fact that MIG was historically perceived as profitable, even after the payment of substantial commissions to the lending institutions, and may even have been regarded as "money for old rope". The apparent profitability was reinforced by the accounting conventions employed, and latterly profits may have been more apparent than real.

1.2 Nature of insurance

The purpose of MIG insurance is to indemnify a <u>lender</u> against certain losses which can arise as a result of lending to a borrower who subsequently defaults on the loan. The insurance is normally effected at the inception of the loan by the payment of a single premium, the cost of the cover being met by the borrower, either as a lump sum or as an addition to the amount of the loan. The cover then lasts for the duration of the mortgage, which is often nominally 25 years although in practice few loans last for the full term.

1.3 Long term nature of the business

A fundamental characteristic of MIG business is that a single premium is paid at the inception of the mortgage, to cover the possibility of a claim arising during the rest of the term of the contract, which may be up to 25 years. This feature distinguishes MIG from almost all other classes of non-life business, although there are some parallels with extended warranty insurance. The long term nature of the business adds considerably to the complexity of assessing profitability and poses particular problems with respect to the establishment of unearned premium reserves and additional reserves for unexpired risks, if required. These aspects of the business are likely to be of particular interest to actuaries, and offer scope for the application of actuarial and statistical techniques. This section of the report aims to describe the basic features of MIG business and to examine what may be regarded as the current approach to reserving within the constraints of traditional accounting methods. Consideration of the theoretical and practical inadequacies of this approach is deferred to section B.

1.4 Changes in the mortgage market

The market in mortgages has grown considerably in the last few years. Originally the domain of Building Societies, the market of providers has been expanded to include banks, mortgage corporations and subsidiaries of life assurance companies. As the market has expanded, lending conditions have been relaxed in the competition to attract business, and the demand for MIG insurance has grown accordingly.

There has also been an increase in the number of different types of mortgage offered by a single lender. This has been a consequence of the de-regulation of the Building Societies and new lenders competing for a share of the market. Features available include higher income multiples and self-certification of income. The major lenders also introduced tighter arrears procedures to "catch a problem" before it developed, since in order to obtain wholesale funding these lenders were having to perform to standards imposed by outside financiers.

1.5 Trend in claims experience

Recent years have seen very significant increases in both the number and amount of claims on this class of business. Various reasons for this can be cited, including the following:-

1. Greatly increased competition within the domestic mortgage market. This is illustrated in the table below and the pie charts on the next page.

Net new advances for house purchase

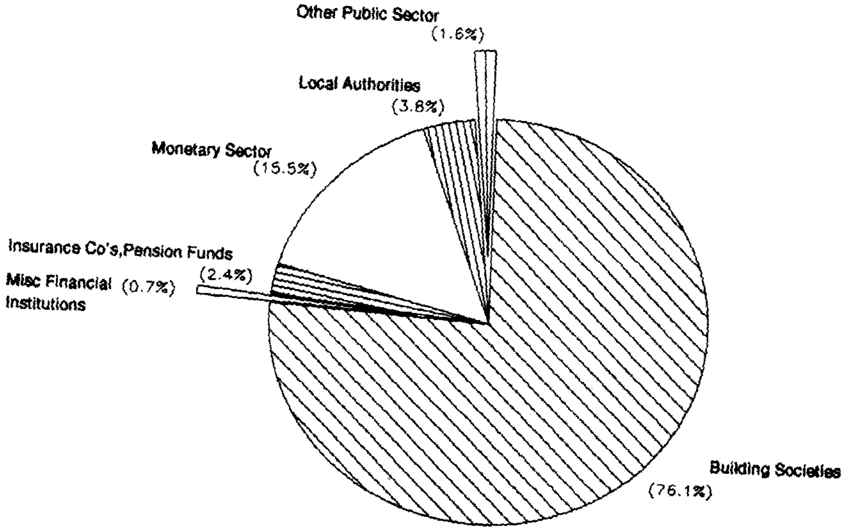
LENDER	1984		1989	
	£m	%	£m	%
Building Societies	14,572	85.36	24,041	71.14
Monetary Sector inc. banks	2,043	11.97	7,158	21.18
Misc. Financial Institutions	445	2.61	2,546	7.53
Insurance Co's,Pension Funds	250	1.46	119	0.35
Other Public Sector	(43)	(0.25)	129	0.38
Local Authorities	(195)	(1.14)	(200)	(0.59)
Total	17,072	100.00	33,793	100.00

Source: Housing Finance, May 1990.

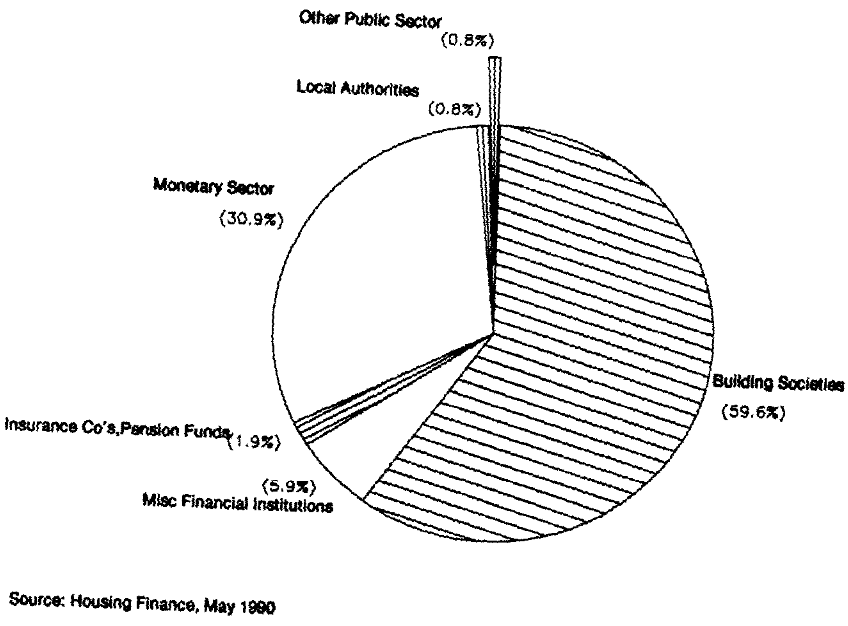
2. Lowering of lending standards by Building Societies and other institutions in providing higher income multiples and a greater proportion of advances in excess of 90% of valuation.
3. High levels of unemployment - see graph of unemployment rates.
4. Increase in marital breakdowns - see graph illustrating numbers of divorces.
5. Stagnation of house prices in certain areas.
6. Interest rates at a high level relative to rates of inflation.

The increase in claim cost has meant substantially reduced profits, because insurers were slow to recognise the trend in claims experience and increase rates accordingly. By the time the rates were increased, because of the long term nature of the business, a considerable amount of unprofitable business had already been written.

BALANCES OUTSTANDING AS AT 31.12.84

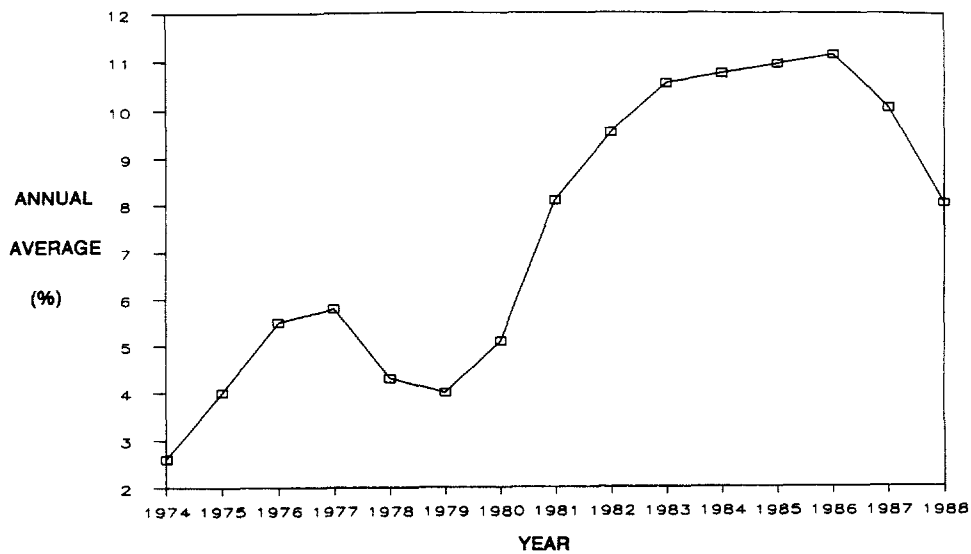


BALANCES OUTSTANDING AS AT 31.12.89

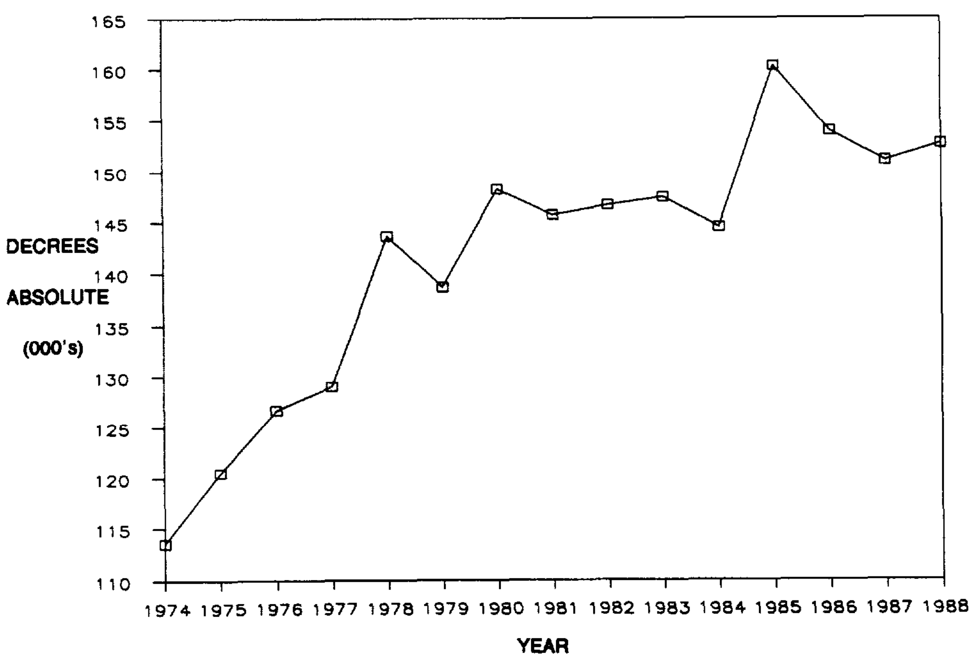


Source: Housing Finance, May 1990

RATES OF UNEMPLOYMENT IN THE UK



NUMBERS OF DECREES ABSOLUTE GRANTED IN ENGLAND & WALES



Source: CSO Statistics

2) Description of the policy

2.1 Normal advance

The amount which a lender will advance on a particular property is related to the valuation of the property. The lender will normally be willing to advance between 70% and 80% of the valuation - the "normal advance" - without mortgage guarantee insurance, but will probably be willing to advance a higher percentage - possibly up to 100% - provided that mortgage guarantee insurance is taken out on the excess over the normal advance.

2.2 Policy cover

An MIG insurance is for the benefit of the lender, not the borrower, and covers certain losses which may arise as a result of the lender selling the property following default on mortgage repayments by the borrower, or as a result of a compulsory purchase, demolition or closing order. A claim will arise if the proceeds of the enforced sale are insufficient to cover the outstanding debt, which comprises the following items:-

i) Principal plus unpaid interest due to the lender.
ii) Legal charges incurred by the lender in the recovery (or attempted recovery) of the sum due.
iii) Estate agent's commission on sale.
iv) Any other costs, such as essential repairs and insurance premiums.

2.3 Circumstances giving rise to claims

The reason for a claim may be simply the delinquency of the borrower - i.e. for some reason the borrower ceases making mortgage payments, and by the time the property is sold the accumulated outstanding debt exceeds the sale proceeds. Clearly, the longer the period of arrears before the sale is completed, the greater the amount outstanding.

However, a default case is more likely to give rise to an MIG claim if there has been a decline in the value of the property. The following are possible reasons for such a decline in value:-

a) A general decline in property values throughout the country.
b) A regional decline in property values.
c) A decline in the value of a particular property caused by, for example:

    i) Deterioration due to lack of maintenance.
    ii) Deterioration of immediate surroundings or adjacent property.
    iii) The imposition of a compulsory purchase order, eg for redevelopment.
    iv) Damage or structural fault.
    v) Negligent or fraudulent initial value.
    vi) Defective or imperfect title.
    vii) The basis and manner in which the property is sold.

Some of these may be covered by more specific insurance. Others can be recovered from the legal and professional advisors of the lender. Essentially, MIG is underwriting the lender's lending criteria and administrative procedures, and it is important that these should be thoroughly understood.

2.4 Block policies

The single premium required for MIG insurance is paid at the inception of the loan; it may be paid in cash by the borrower or added to the amount of the advance. The lending institution normally has a single block policy with the insurer, covering all the cases which have been placed with that insurer. New cases are added to the policy continuously, and the premiums in respect of them are remitted to the insurer at intervals, say monthly or quarterly. Full details of each case covered by the policy are maintained by the lender, but are not passed to the insurer unless and until a claim is made. Thus the insurer does not keep records of the individual mortgages covered under the block policy, but merely records the total premium received in respect of mortgages incepted in a particular period. (This is known as a "no records" block policy.)

Although block policies are important, the reason for their existence is primarily the use of archaic accounting systems. Modern financial instruments (eg securitization) require greater information and, accordingly, this is now being kept by lenders and made available to insurers.

2.5 Premium rating

The premium charged is calculated as a percentage of the excess of the actual advance over the normal advance. Historically, the percentage rate used varied according to the term of the mortgage and the percentage of the valuation advanced. In 1986, typical rates were as follows:-

% of Valuation Loaned	Term of Mortgage 20 years or less	Over 20 years
95% or less	£2.30%	£3.30%
Over 95%	£2.80%	£3.80%

Following the realisation that the rates charged were generally inadequate, rates were generally increased in 1987. The term of the mortgage was dropped as a rating factor, being largely irrelevant since most claims arise at the earlier durations, and a greater variation in rates according to the actual percentage advanced and the percentage level of the normal advance was introduced. The following premium rates, again expressed as a percentage of the excess advance, are typical of those now used by leading UK underwriters:-

% of Valuation	Normal Advance		
Loaned	70%	75%	80%
90% or less	£3.00%	£3.50%	£4.00%
90% to 95%	£4.00%	£4.50%	£5.50%
Over 95%	n/a	£7.00%	£8.00%

These rates generally apply to the first mortgage on a property, on a repayment or endowment basis. In theory, interest only loans are subject to an additional loading of £1%, although this is waived in many cases.

Ideally, the portfolio should satisfy the following conditions:
a) An even geographical spread of loans.
b) A maximum guarantee, expressed as a percentage of the valuation.
c) A minimum premium per guarantee.
d) No refunds (except in special circumstances).

When requested to quote for MIG insurance, the insurer will require a copy of the lender's detailed lending criteria. An indication of what this should include is set out in Appendix 1, along with notes on mortgage product profiles and premium refunds. The insurer will also require details of the lender's procedures for handling arrears of payments.

The important principle of this business is that the building society acts in the same manner as an underwriting agency. The insurance company effectively gives the building society its set of rates and "the pen". What the insurer does is underwrite the administrative procedures of the building society. The building society receives commission for the service, in the same way that underwriting agencies receive commission.

Theoretically, the rating is controlled through the granting of bonus or profit commission. If the block of business underwritten is good then the building society receives more commission and vice versa. In practice the ability to identify the good and bad risks is only partial.

Whenever a building society changes its practices, the commission element should in theory be reviewed. This is rarely done in practice. To some extent the absence of typical agency controls by the insurer is a weakness in the system.

2.6 Commission terms

Traditionally, the commission rates paid to lenders by insurers on mortgage guarantee business have been high. The basic rate of commission was 20%, to which was added 10% "special commission" and a further amount of "profit commission" calculated in accordance with a formula. The total commission payable was normally limited to 40% of the premium. However, the formulae for calculating the "profit commission" were apparently generally crude and did not correctly take into account the long term nature of the business. This tended to be very advantageous to the lenders, particularly when the volume of business and hence the premium income were expanding. Following the revision of premium rates, the commission payable was limited to 30% and the existing profit-sharing arrangements were phased out. However, some insurers are understood to be considering the re-introduction of profit commission on a more realistic basis.

In the case of a broker introduction, no separate brokerage is generally offered; the scale rate is quoted and the broker is invited to negotiate his share.

3) Claims procedure

3.1 Process leading to a claim

The process leading up to the reporting of a claim can be a lengthy one and will comprise the following stages:

a) The mortgage repayments fall significantly into arrears. Lenders vary in the action they take on arrears and how soon they seek re-possession. The lender may initially try to assist the borrower to keep the loan in force, for example by re-scheduling repayments. Some borrowers fall into arrears from the outset - which perhaps reflects badly on the lender's lending policy.

b) The property is re-possessed by the lender. This may be achieved fairly easily with the agreement of the borrower, or it may be necessary to take legal action to achieve re-possession. The latter may take years if the borrower "pretends" to the court that he will pay off the arrears over a period.

c) The property is placed on the market. This stage is likely to last for months or in some cases years, as the properties are often in less popular areas or of poor quality and are less attractive to purchasers because they may have been standing empty for some time.

d) The property is sold. For insurance purposes the claim is incurred on the completion date of the sale, since it is only then that the computations to determine whether the lender has made a loss can be carried out. Clearly not all repossessions ultimately lead to MIG claims.

e) The exact amount of the claim is calculated and the claim is reported to the insurer.

It is clear that there will be a period of some months or even years between the commencement of the arrears and the completion date of the sale.

3.2 Calculation of claim amount

The loss which the lender would sustain in the absence of MIG is calculated as follows:

Amount of advance
\+ Interest payable on loan from commencement of mortgage to date of completion of sale
\+ Outgoings in respect of period of arrears and expenses of sale
\- Total repayments made by the borrower
\- Sale proceeds of property

Frequently, depending on the provisions of the policy, the lender has to bear the "Normal Loss", calculated as follows:

Normal advance
\+ Interest payable on normal advance from commencement of mortgage to date of completion of sale
\- Proportion A of repayments made by the borrower
\- Total sale proceeds of property.

The proportion A is calculated as normal advance/actual advance.

If the result of this calculation is negative, the "Normal Loss" is taken as zero.

The claim amount is calculated as the total potential loss to the lender less the "Normal Loss". It is worth noting that the "Normal Loss" does not include any proportion of the expenses associated with the re-possession and sale, but does take account of the whole of the sale proceeds. Two examples of claim calculations are included in Appendix 2.

3.3 Claims settlement

Once reported to the insurer, Mortgage Guarantee claims are usually settled quickly, as the amount of the claim will have been calculated by the lender on the agreed basis as set out in the policy. This rapid settlement is reflected in the low level of outstanding claims reserves for reported claims required at the year end. It should be noted that accounts in arrears and properties in possession are not outstanding claims, but potential claims; a claim can occur only when the property has been sold.

3.4 Delays in reporting

As noted above, claims are usually settled quickly once notified to the insurer. However, there may sometimes be significant delays in lenders reporting claims and requesting settlement. This may arise because of difficulties in assessing the expenses of the sale and outgoings during the period of arrears or because the lender has a backlog of claims awaiting processing. In normal circumstances the volume of IBNR claims at the year end may be expected to be fairly small, but any backlog of claims in the lender's hands will of course increase the IBNR provision required. It may be worth making enquiries as to whether exceptional volumes of claims are awaiting processing by the lender at the year end.

4) The incidence of claims

4.1 Date of origin

Any particular case subject to mortgage indemnity guarantee will give rise to at most one claim - unlike extended warranty business where there can be a number of claims during the life of a policy. It will be seen that during the period leading up to the notification of a claim to the insurer, there are a number of significant dates, such as:

date of first missed payment
date of re-possession
date of completion of sale.

In what follows, the date of completion of the sale has been taken as the date of origin of the claim, as that is the earliest date at which the computations to determine whether the lender has made a loss can be carried out. If any earlier date were to be used, for example if the insurer were to be notified of all re-possessions with MIG cover and treated them all as claims, a large number of nil claims would result, since not all such cases would give rise to eventual losses.

It is of course true that a proportion of cases in arrears or in possession will in due course give rise to MIG claims. If the relevant proportions could be estimated and statistics relating to cases in arrears or in possession with MIG cover were available, estimates of the number and amount of such "pipeline claims" at a particular time could be made.

4.2 Pattern of incidence

In theory, a claim can occur at any time during the term of the mortgage, but in practice very few claims will be incurred in the year the policy is written because there is inevitably a delay between the repayments falling into arrears and the property being sold. A high proportion of claims are incurred in the third, fourth and fifth years of the mortgage, and very few claims are incurred after year ten. This pattern of incidence seems reasonable on general grounds, for the following reasons:-

a) As the duration of the loan increases, the repayments will decrease in real terms, making them seem less onerous to the borrower. Therefore, if repayments are to fall into arrears, this is likely to happen at an early stage.

b) If a property is repossessed at a later duration, it is more likely that there will be an increase in the property value sufficient to discharge the losses.

c) The average life of a mortgage is often quoted as being about seven years, although we have been unable to find a statistical justification for this. However, a market research survey conducted for the Building Societies Assocation indicated that mortgage holders had lived at their current address for an average of about six years, and clearly most loans are repaid before the end of the term when the borrower moves house. It is likely that only a relatively small proportion of loans will survive beyond duration 10, say.

4.3 Distribution of claims over the term of the policy

It is important to make a detailed analysis of the incidence of claims in order to assist in the determination of a reasonable basis for the earning of premiums. For each claim, the date the mortgage was granted must be ascertained and recorded so that an analysis by underwriting year may be carried out. The tables which follow contain data provided by two insurers, suitably doctored, and illustrate the development of the numbers and amounts of claims for each year of writing, together with the gross written premium figures for each year of writing.

In the case of company A, the distribution is given according to the year of payment of the claim, year of payment 1 being the calendar year of writing. In the case of company B, the distribution is by year of origin, ie year of completion of sale. Clearly in some cases the claim will be paid in a year later than the year of origin, and so a distribution by year of payment may be expected to show claims at later durations than a distribution by date of origin, but it will be seen that the figures exhibit many of the same features.

4.4 Features of the distributions

The information tabulated is as follows:-

Tables 1A and 1B	- numbers of claims for companies A and B respectively
Tables 2A and 2B	- claim amounts
Tables 3A and 3B	- average claim amounts
Tables 4A and 4B	- claim amounts as a percentage of gross written premiums.

It should be noted that for Tables 1, 2 and 3, a diagonal in the table corresponds to the claims paid (company A) or originating (company B) in a particular calendar year, so that for example the last diagonal corresponds to 1989 in each case.

The following features may be noted particularly:

a) There is a concentration of claims in years 3, 4 and 5.
b) Years of writing 1980 and later exhibit significantly higher claim ratios than earlier years, and more claims are arising later in the policy term.
c) Certain diagonals (calendar years of payment/origin) stand out as containing particularly high figures. It appears that the figures for 1986, 1987 and 1988 were exceptionally high. Part of the explanation for this is no doubt that this was a period when the housing market was buoyant and when repossessed properties could be sold fairly easily, thus realising the loss. If the market is depressed and properties cannot be sold, the resultant MIG claims will be deferred until more favourable conditions return - hence the current time-bomb situation!
d) In general, the average claim amount for a particular year of writing increases with calendar year of payment/origin. If we ignore cells where the number of claims is very small, it also appears to be generally true that for a particular calendar year of payment/origin, the average amount increases with year of writing. The factors affecting claim amounts will be discussed in more detail in the next section.

TABLE 1A

COMPANY A

NUMBERS OF CLAIMS

Year of writing	Written premium	Year of payment 1	2	3	4	5	6	7	8	9	10	11
1972	500,136		1	4	13	7	5	2	3	5		1
1973	390,488		3	37	29	14	8	3	3	3		
1974	251,318	1	6	24	19	17	6	1	2	2	2	1
1975	461,665		9	44	45	35	4	2	2		1	
1976	823,205		5	49	44	23	12	5	5	1	3	
1977	816,920		1	22	18	10	1	2	1	2	4	2
1978	1,196,559		4	6	5	10	5	11	4	3	3	5
1979	876,172	1	2	5	14	20	12	5	5	4	2	2
1980	713,653			26	66	32	29	9	9	9	2	
1981	1,275,670	1	6	70	68	67	42	41	30	9		
1982	1,815,485	1	15	89	155	197	138	79	54			
1983	2,085,493	2	8	69	180	153	114	48				
1984	2,517,582		15	201	260	188	125					
1985	3,299,740	1	65	207	230	156						
1986	4,449,647	4	40	176	214							
1987	6,860,151	21	48	77								
1988	7,938,462	12	8									
1989	4,903,298	7										

TABLE 1B

COMPANY B

NUMBERS OF CLAIMS

Year of writing	Written premium	Year of origin 1	2	3	4	5	6	7	8	9	10	11	12	13	14
1975	1,615,000		15	66	81	22	11	2		1	3	1			1
1976	1,877,000		19	99	52	24	3	3				1	2	3	
1977	2,076,000		13	15	11	10	2	7	3	4	6	4	5	1	
1978	2,505,000		5	10	15	16	13	8	6	5	3	3	1		
1979	1,695,000			17	46	38	12	13	8	13	9				
1980	1,770,000			73	110	58	42	20	15	14	9				
1981	2,798,000		38	149	195	129	93	53	31	11					
1982	4,169,000	11	59	370	398	255	194	96	18						
1983	5,913,000	11	98	435	493	308	160	40							
1984	6,950,000	11	177	627	473	326	79								
1985	7,859,000	14	210	509	430	124									
1986	13,027,000	24	203	617	259										
1987	17,374,000	19	143	195											
1988	22,406,000	20	56												
1989	18,949,000	4													

TABLE 2A

COMPANY A

CLAIM AMOUNTS

Year of writing	Written premium	Year of payment 1	2	3	4	5	6	7	8	9	10	11
1972	500,136		35	1,580	8,968	5,157	1,645	2,340	2,120	6,389		1,398
1973	390,488		2,904	28,705	24,407	9,914	9,436	5,078	2,922	4,451		
1974	251,318	1,077	4,163	20,099	27,018	14,768	7,088	2,796	4,031	1,249	1,309	2,396
1975	461,665		6,492	37,420	42,751	35,578	5,641	3,681	2,571		2,633	
1976	823,205		3,570	36,058	35,539	26,796	12,647	5,725	5,242	155	1,633	
1977	816,920		218	17,142	8,557	10,678	2,620	1,685	713	2,127	4,933	6,958
1978	1,196,559		1,676	4,325	8,583	12,297	8,528	16,979	4,272	4,087	17,420	15,126
1979	876,172	1,303	1,065	5,599	21,516	35,498	17,033	5,272	15,897	8,776	5,056	7,265
1980	713,653			41,803	144,085	67,291	59,626	13,449	23,085	19,816	3,762	
1981	1,275,670	1,756	10,286	184,922	187,026	171,651	101,259	150,089	113,858	27,480		
1982	1,815,485	1,814	32,573	235,795	364,809	599,687	576,142	315,723	208,201			
1983	2,085,493	2,101	15,715	161,659	584,000	587,667	456,618	195,480				
1984	2,517,582		35,786	630,307	995,834	762,464	498,917					
1985	3,299,740	2,140	166,243	749,346	993,383	647,762						
1986	4,449,647	17,341	140,769	808,766	921,258							
1987	6,860,151	81,444	193,325	332,759								
1988	7,938,462	42,525	28,703									
1989	4,903,298	37,639										

TABLE 2B

COMPANY B

CLAIM AMOUNTS

Year of writing	Written premium	Year of origin 1	2	3	4	5	6	7	8	9	10	11	12	13	14
1975	1,615,000		8,213	45,128	74,992	17,561	9,427	2,053		6,216	3,173	2,721			1,396
1976	1,877,000		9,642	68,454	38,795	22,289	4,247	5,900				1,266	4,170	2,318	
1977	2,076,000		6,143	8,847	6,768	8,348	2,671	11,734	2,075	5,256	15,344	14,638	13,885	1,753	
1978	2,505,000		3,677	10,455	10,547	31,934	12,514	13,480	9,249	6,355	6,447	13,536	2,519		
1979	1,695,000			19,590	72,162	71,135	18,406	34,958	16,197	33,540	30,822				
1980	1,770,000			152,795	218,881	147,220	115,146	47,126	38,091	43,956	29,497				
1981	2,798,000		69,924	348,629	551,093	332,797	286,821	171,869	87,673	43,253					
1982	4,169,000	24,492	117,275	842,521	1,158,368	819,322	721,962	364,958	66,862						
1983	5,913,000	32,848	241,834	1,247,955	1,680,790	1,242,500	712,854	183,804							
1984	6,950,000	21,439	508,389	2,370,473	2,098,718	1,461,093	393,792								
1985	7,859,000	40,397	722,997	2,157,351	2,068,827	658,991									
1986	13,027,000	90,748	861,246	3,258,646	1,655,842										
1987	17,374,000	62,096	806,384	1,086,317											
1988	22,406,000	24,983	259,458												
1989	18,949,000	13,121													

TABLE 3A

COMPANY A

AVERAGE CLAIM AMOUNTS

Year of writing	Year of payment 1	2	3	4	5	6	7	8	9	10	11
1972		35	395	690	737	329	1170	707	1278		1398
1973		968	776	842	708	1180	1693	974	1484		
1974	1077	694	837	1422	869	1181	2796	2016	625	655	2396
1975		721	850	950	1017	1410	1841	1286		2633	
1976		714	736	808	1165	1054	1145	1048	155	544	
1977		218	779	475	1068	2620	843	713	1064	1233	3479
1978		419	721	1717	1230	1706	1544	1068	1362	5807	3025
1979	1303	533	1120	1537	1775	1419	1054	3179	2194	2528	3633
1980			1608	2183	2103	2056	1494	2565	2202	1881	
1981	1756	1714	2642	2750	2562	2411	3661	3795	3053		
1982	1814	2172	2649	2354	3044	4175	3996	3856			
1983	1051	1964	2343	3244	3841	4005	4073				
1984		2386	3136	3830	4056	3991					
1985	2140	2558	3620	4319	4152						
1986	4335	3519	4595	4305							
1987	3878	4028	4322								
1988	3544	3588									
1989	5377										

TABLE 3B

COMPANY B

AVERAGE CLAIM AMOUNTS

Year of writing	Year of origin 1	2	3	4	5	6	7	8	9	10	11	12	13	14
1975		548	684	926	798	857	1027		6216	1058	2721			1396
1976		507	691	746	929	1416	1967				1266	2085	773	
1977		473	590	615	835	1336	1676	692	1314	2557	3660	2777	1753	
1978		735	1046	703	1996	963	1685	1542	1271	2149	4512	2519		
1979			1152	1569	1872	1534	2689	2025	2580	3425				
1980			2093	1990	2538	2742	2356	2539	3140	3277				
1981		1840	2340	2826	2580	3084	3243	2828	3932					
1982	2227	1988	2277	2910	3213	3721	3802	3715						
1983	2986	2468	2869	3409	4034	4455	4595							
1984	1949	2872	3781	4437	4482	4985								
1985	2886	3443	4238	4811	5314									
1986	3781	4243	5281	6393										
1987	3268	5639	5571											
1988	1249	4633												
1989	3280													

TABLE 4A

COMPANY A

CLAIM PAYMENTS / WRITTEN PREMIUMS %

Year of writing	Written premium	Year of payment 1	2	3	4	5	6	7	8	9	10	11	TOTAL
1972	500,136	0.0	0.0	0.3	1.8	1.0	0.3	0.5	0.4	1.3	0.0	0.3	5.9
1973	390,488	0.0	0.7	7.4	6.3	2.5	2.4	1.3	0.7	1.1	0.0	0.0	22.4
1974	251,318	0.4	1.7	8.0	10.8	5.9	2.8	1.1	1.6	0.5	0.5	1.0	34.3
1975	461,665	0.0	1.4	8.1	9.3	7.7	1.2	0.8	0.6	0.0	0.6	0.0	29.7
1976	823,205	0.0	0.4	4.4	4.3	3.3	1.5	0.7	0.6	0.0	0.2	0.0	15.4
1977	816,920	0.0	0.0	2.1	1.0	1.3	0.3	0.2	0.1	0.3	0.6	0.9	6.8
1978	1,196,559	0.0	0.1	0.4	0.7	1.0	0.7	1.4	0.4	0.3	1.5	1.3	7.8
1979	876,172	0.1	0.1	0.6	2.5	4.1	1.9	0.6	1.8	1.0	0.6	0.8	14.1
1980	713,653	0.0	0.0	5.9	20.2	9.4	8.4	1.9	3.2	2.8	0.5		52.3
1981	1,275,670	0.1	0.8	14.5	14.7	13.5	7.9	11.8	8.9	2.2			74.4
1982	1,815,485	0.1	1.8	13.0	20.1	33.0	31.7	17.4	11.5				128.6
1983	2,085,493	0.1	0.8	7.8	28.0	28.2	21.9	9.4					96.2
1984	2,517,582	0.0	1.4	25.0	39.6	30.3	19.8						116.1
1985	3,299,740	0.1	5.0	22.7	30.1	19.6							77.5
1986	4,449,647	0.4	3.2	18.2	20.7								42.5
1987	6,860,151	1.2	2.8	4.9									8.9
1988	7,938,462	0.5	0.4										0.9
1989	4,903,298	0.8											0.8

TABLE 4B

COMPANY B

CLAIM PAYMENTS / WRITTEN PREMIUMS %

Year of writing	Written premium	Year of origin 1	2	3	4	5	6	7	8	9	10	11	12	13	14	TOTAL
1975	1,615,000	0.0	0.5	2.8	4.6	1.1	0.6	0.1	0.0	0.4	0.2	0.2	0.0	0.0	0.1	10.6
1976	1,877,000	0.0	0.5	3.6	2.1	1.2	0.2	0.3	0.0	0.0	0.0	0.1	0.2	0.1		8.3
1977	2,076,000	0.0	0.3	0.4	0.3	0.4	0.1	0.6	0.1	0.3	0.7	0.7	0.7	0.1		4.7
1978	2,505,000	0.0	0.1	0.4	0.4	1.3	0.5	0.5	0.4	0.3	0.3	0.5	0.1			4.8
1979	1,695,000	0.0	0.0	1.2	4.3	4.2	1.1	2.1	1.0	2.0	1.8					17.7
1980	1,770,000	0.0	0.0	8.6	12.4	8.3	6.5	2.7	2.2	2.5	1.7					44.9
1981	2,798,000	0.0	2.5	12.5	19.7	11.9	10.3	6.1	3.1	1.5						67.6
1982	4,169,000	0.6	2.8	20.2	27.8	19.7	17.3	8.8	1.6							98.8
1983	5,913,000	0.6	4.1	21.1	28.4	21.0	12.1	3.1								90.4
1984	6,950,000	0.3	7.3	34.1	30.2	21.0	5.7									98.6
1985	7,859,000	0.5	9.2	27.5	26.3	8.4										71.9
1986	13,027,000	0.7	6.6	25.0	12.7											45.0
1987	17,374,000	0.4	4.6	6.3												11.3
1988	22,406,000	0.1	1.2													1.3
1989	18,949,000	0.1														0.1

TABLE 5

Calendar year of payment/ origin	COMPANY A No. of claims	COMPANY A Total payments	COMPANY A Average payments	COMPANY B No. of claims	COMPANY B Total payments	COMPANY B Average payments	Co. A Index of ave pyts (1983=100)	Co. B Index of ave pyts (1983=100)	AEI --- Index=100 in 1983 ---	RPI	Ave. House Price Index
1975	56	41,836	747	0	0		34	0	38	34	42
1976	69	56,155	814	15	8,213	548	37	26	44	42	45
1977	87	79,567	915	85	54,770	644	41	31	48	49	49
1978	122	105,571	865	193	149,589	775	39	37	55	57	57
1979	118	105,524	894	94	68,880	733	40	35	63	61	74
1980	62	58,491	943	56	48,939	874	42	41	57	70	85
1981	40	51,426	1286	47	44,785	953	58	45	86	82	87
1982	68	101,279	1489	189	359,878	1904	67	90	94	92	89
1983	187	415,943	2224	388	819,232	2111	100	100	100	100	100
1984	224	545,736	2436	758	1,841,241	2429	110	115	109	105	108
1985	350	808,975	2311	1219	3,455,236	2834	104	134	116	110	116
1986	710	2,137,203	3010	1742	6,057,439	3477	135	165	124	116	133
1987	878	3,337,530	3801	1796	7,412,628	4127	171	195	134	120	155
1988	893	3,726,660	4173	1858	8,891,331	4785	188	227	147	126	190
1989	702	2,909,226	4144	797	4,395,209	5515	186	261	160	136	217

4.5 Factors affecting average amounts of claims

The average amount of a mortgage guarantee claim may be expected to depend on:

i) the level of house prices at the date of the sale;
ii) the amount of the original mortgage, which in turn depends on the property value at the purchase date and the percentage advance;
iii) the level of interest rates prevailing during the period of arrears;
iv) the length of the arrears period, which in turn depends partly on the lender's arrears control procedure and partly on the state of the housing market (ie how quickly a repossessed property can be sold).

The interaction of these various factors is complex, and it is not easy to model the average amounts of mortgage guarantee claims. It is of some interest, however, to examine the past progression of average amounts from one year of payment/origin to another, and Table 5 sets out the average payments for companies A and B. The progression of these average payments has then been expressed in index form, taking the 1983 average as 100 in each case. For comparison, the table also shows the values of the Average Earnings Index (AEI), the Retail Price Index (RPI) and an Index of Average House Prices, with the 1983 value adjusted to 100 in each case.

It will be noticed that the average amounts for Company B appear to have been increasing more rapidly than for Company A; it is assumed that this reflects differences between the two underlying portfolios. However, for both companies, the average claim amount has been increasing more rapidly than either the AEI or the RPI, and for Company B the rate of increase has also outstripped the Index of Average House Prices.

5) Earned premiums and the reserves for unexpired risks

5.1 Nature of MIG

Under MIG insurance, the single premium paid at the outset covers the possibility of a claim arising at any time during the currency of the loan. At the end of each year, it is necessary to set aside reserves to cover claims which are expected to arise in the future on contracts already in force. This type of business differs from annual premium classes in that the unearned premium for MIG relates to unexpired risks extending over a number of future years. For each year of writing, the unearned premium reserve should be calculated in accordance with the expected distribution of claims. If the unearned premium reserve seems likely to prove inadequate, consideration should be given to setting up an additional provision for unexpired risks.

5.2 The current approach

The conventional approach, constrained by accounting and taxation requirements, is to use an undiscounted unearned premium reserve, and to take investment income into each year's revenue account as it emerges. Possible alternative approaches will be considered in Section B.

The traditional approach suggested here is that of spreading the actual written premium forward over a number of years, in line with the expected distribution of claims. If the premium is adequate, this should lead to the release of some profit each year. However, if the premium is inadequate, losses will emerge, and in the later years of exposure there may still be losses after taking account of investment income, since the investment income attributable to a given year of writing will decline as the UPR declines. In this case, the establishment of an additional reserve for unexpired risks may need to be considered.

It should be noted that a UPR approach which spreads the written premium in proportion to the expected claims profile takes no account of investment income, which is brought into account in the year it is earned. However, the rating basis may anticipate the investment income to be earned in the future, in which case the traditional UPR method will be wrong. Either an additional reserve for unexpired risks will be required at the outset, or investment income must be used to supplement the effectively discounted provision.

5.3 Features of the claim distribution

From the previous section, it is clear that claims are not evenly distributed over the life of the contract, so that it is not appropriate to assume that the premiums are earned uniformly over the term of the loan. The following features of the distribution are significant:

a) Very few claims are incurred after year 10. This is partly because a high proportion of people move house within 10 years of the mortgage being granted, so that the mortgage ceases, and partly because at the later durations the increase in the value of the property is more likely to compensate for the repayments lost and the expenses of re-possession.

b) Very few claims are incurred in the first year. This is because there is inevitably a delay between repayments falling into arrears and a claim being incurred, so that even where repayments fall into arrears from the outset, the claim may not arise in the first year.

c) There is a concentration of claims in years 3, 4, 5 and 6, with a peak in years 4 and 5. After year 6, the proportion incurred in each year decreases rapidly.

d) The average amount of a claim tends to increase with year of development.

5.4 Basis for earned premiums and the UPR

It is desirable to choose a basis for unearned premiums which will not require frequent alteration from one year to another, although of course it will be necessary to keep the claims experience under review and to modify the basis for earned premiums in line with any significant changes in the distribution of claims.

It is assumed that commission will be treated as being earned at the same time as the premium to which it relates, so that the percentages set out below will apply equally to gross premiums, commission, and premiums net of commission. The earned premiums net of commission will be available to pay the claims incurred in the relevant period.

As an example, for companies A and B, the percentages applied to the total written premiums and corresponding commission in each year to give the distribution of earned premiums are as follows:

	% earned in year:									
Year	1	2	3	4	5	6	7	8	9	10
Company A %	0	5	15	20	20	15	10	7	5	3
Company B %	1	7	33	35	14	5	5	0	0	0

The percentages of written premiums and commission which are deemed to be unearned at the end of each year are then as follows:

	% unearned at end of year:									
Year	1	2	3	4	5	6	7	8	9	10
Company A %	100	95	80	60	40	25	15	8	3	0
Company B %	99	92	59	24	10	5	0	0	0	0

5.5 Additional provision for unexpired risks

As mentioned above, if there is felt to be a danger that the net unearned premiums will prove insufficient to meet the cost of the future claims, then consideration needs to be given to the establishment of an additional provision for unexpired risks.

The considerations to be taken into account in deciding whether an additional provision for unexpired risks is required and if so at what level it should be set are complex. A projection of the future claims experience will be required, and this is likely to be far from straightforward, because the level of future claims will depend on future economic circumstances. The incidence of "catastrophe" years in the future will need to be considered, although one possibility would be to allow for these by establishing some form of contingency fund. Essentially, the projected claims should then be compared with the unearned premium reserve, but it will be appropriate to make an allowance for future investment income on the UPR.

In conjunction with the possible establishment of an additional provision for unexpired risks, it will be appropriate to consider the volume of "pipeline claims" - ie future claims which may be expected to arise from cases currently in arrears or possession. The cost of these future claims should normally be covered by the UPR, but if the UPR is felt likely to be inadequate, an additional provision should be established. If suitable statistics are available relating to proportions of cases in arrears or possession which subsequently become claims, it should be possible to establish the additional provision on a statistical basis, and this should enable tax relief to be obtained.

6) Outstanding claims reserves

6.1 Reserve for outstanding reported claims

As mentioned previously, claims are usually settled quickly once reported. There will normally be only a relatively small volume of outstanding reported claims at any time, and for each such claim the amount is likely to be known fairly accurately. It will therefore be appropriate to use the total of the case estimates as the reserve for the outstanding reported claims.

6.2 IBNR claims

At any point in time the claims IBNR will be those cases where the sale of the property has been completed but the claim has not been notified to the insurer for settlement. There will always be some such cases since there will be a delay while the various elements of the claim calculation are obtained. However, long delays can sometimes arise or a distortion in the pattern of reporting may occur as a result of, say, a backlog of claims in the hands of the lender. When a provision for IBNR claims is being made at the year end, it is advisable to enquire of the lender whether there are any special circumstances which might distort the pattern of claims reporting.

In the absence of any special features, the provision of IBNR claims may be based on the experience in earlier years and the number of late reported claims received by an early stage of the new year. The numbers of late-reported claims notified in earlier years may be used to project the total number of IBNR claims at the latest year-end, and the payments on previous late-reported claims may be used to derive the expected average amount of an IBNR claim. The product of the number of claims and their average amount will of course give the provision required. If the expected number of IBNR claims is significant, it may be worth subdividing them according to delay in notification and calculating a separate average amount for each group, since the average amount may be expected to vary with the delay in notification.

7) Reinsurance

Ideally, insurers would like to be able to get stop loss cover to protect their net MIG accounts. MIG business has traditionally been very profitable, but can, and has, turned very sour in periods of economic recession. The losses usually materialise well <u>after</u> the housing market has slumped, as the lending institutions are naturally reluctant to force sales on a depressed market, and tend to wait until there are signs of an upturn in the market before realising the value of their repossessions. There is thence an accumulation of losses from several different underwriting years at once. The aspect of moral hazard is also difficult to overcome, and reinsurers are therefore reluctant to offer such cover.

The only form of cover that reinsurers are normally prepared to offer is quota share. From the insurer's viewpoint this may be thought of as giving away too much profitable business. However, given the current perceived uncertainties regarding the future housing market, this proportional basis does have the merit of equitably sharing the risks between the parties.

SECTION B:

RECENT DEVELOPMENTS &

A LOOK INTO THE FUTURE

B. RECENT DEVELOPMENTS AND A LOOK INTO THE FUTURE

I. FUTURE MARKET DEVELOPMENTS

1) What is the future of the mortgage market?

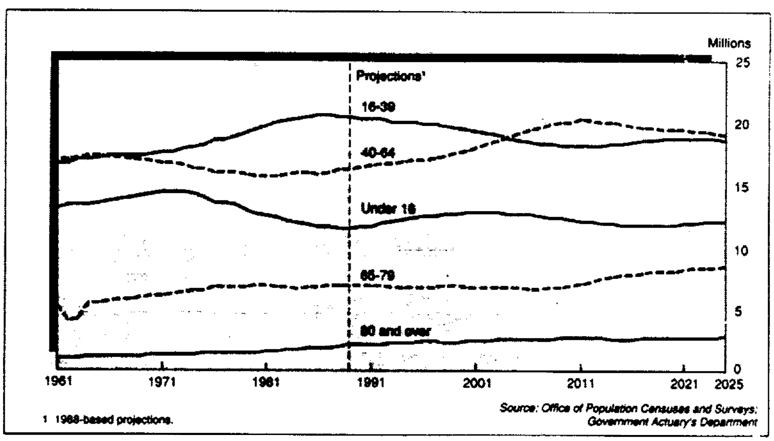
The future of the mortgage market hinges on a variety of issues including

- Demand for owner occupation in the longer term
- Supply of housing on to the market
- Demand for mortgages
- Supply of mortgage finance.

1.1 The demand for owner occupation in the longer term is heavily dependent on the number of new home owners entering the market. The new borrowers, ie new entrants to the housing market, are likely to be dominated by the younger generation. Demographic forces suggest that there will be fewer young people in the next 10-15 years, thus reducing the demand for housing and hence the demand for new mortgages.

The graph below, illustrating population projections in selected age bands, shows a decrease in the 16-39 age group until 2011. After this date the number in this band begins to increase again following the earlier trend of the under 16 year olds.

Population by Selected Age Bands



The last few decades have seen a large increase in the home ownership sector. In particular, this has been enhanced in recent years by the sale of council houses, and the continuation or otherwise of this trend will be an important feature. The number of owner occupied dwellings in the UK more than doubled between 1961 and 1988, so that nearly two-thirds of all dwellings were owner occupied in 1988.

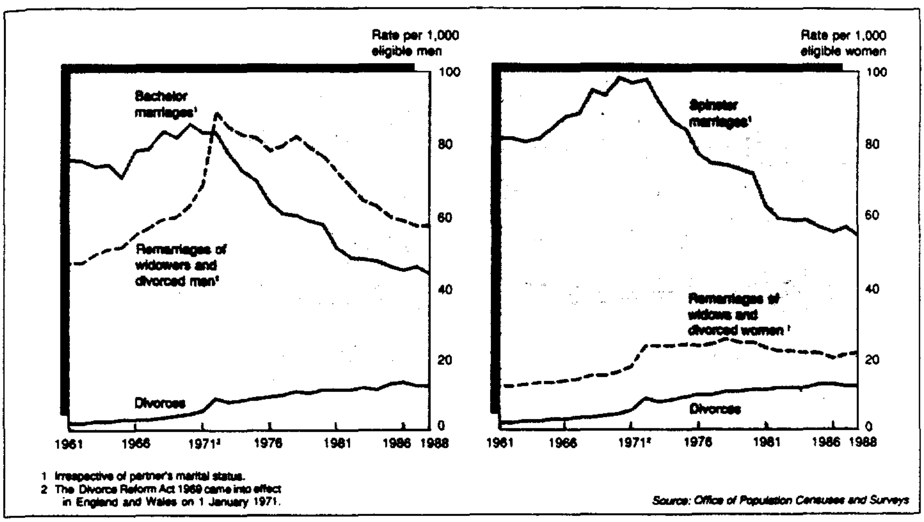
The increase in home ownership among the older generation has resulted increasingly in houses being inherited by younger people on the death of parents or grandparents. This in turn leads to less demand for properties from the younger generation (assuming property is being passed down to grandchildren say). To add to this, reducing family sizes will lead to a greater amount of property being passed down per receiver.

Many young people are unable to afford to buy a property by themselves, especially in the south, and so more people are buying a property between two or even three, thus reducing the demand for houses. The percentages of males aged 25-29 and females aged 20-24 co-habiting have also increased over the last few years. However, this is unlikely to have a marked effect on the demand for housing as it is compensated by the fact that the age of marriage has increased with the number of marriages decreasing.

Divorces are on the increase, and marriages are on the decrease - see below.

<u>Marriages, Remarriages and Divorces : by sex</u>

Great Britain



The rate of formation of new households is expected to decline in the 1990s, although the total number of households will continue to increase. A high proportion of new households are expected to be single person households.

A recent survey indicated an unsatisfied demand for owner occupation. Owner occupation is likely to rise most rapidly amongst lower income or social groups, younger age groups, single people, and in particular parts of the country.

1.2 The supply of housing to the market is a strong influencing factor on the mortgage market. The increase in houses being left in wills may lead to a surplus of housing as fewer young people require to find new homes. A surplus of housing will drive house prices down and hence reduce mortgage demand. The table below shows the change in tenure since 1961.

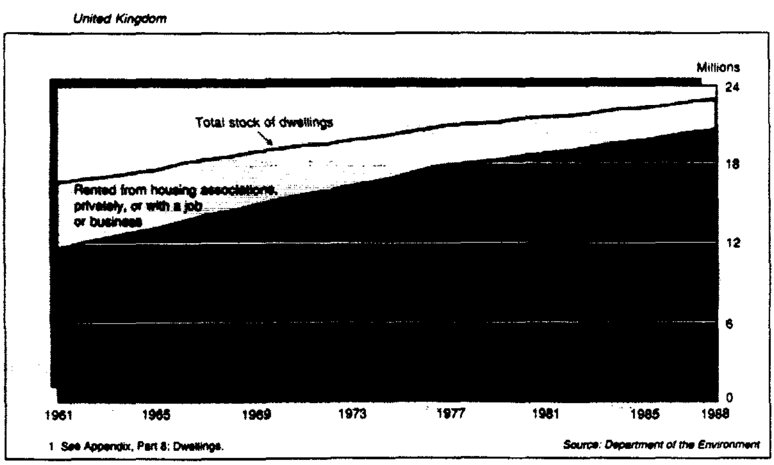
Housing Tenure - Great Britain

	April 1961	April 1971	April 1981	Sept 1989
Owner occupied				
- '000s	6,885	9,427	11,693	14,874
- %	42.3%	50.1%	55.8%	66.0%
Public sector				
- '000s	4,201	5,733	6,502	5,395
- %	25.8%	30.4%	31.0%	23.9%
Private sector rented and others				
- '000s	5,187	3,673	2,326	1,671
- %	31.9%	19.5%	11.1%	7.4%
Housing Association rented				
- '000s	-	-	449	613
- %	-	-	2.1%	2.7%
Total dwellings				
- '000s	16,273	18,833	20,971	22,553

Source: Housing Finance from Housing and Construction Statistics, various issues.

This can also be seen in graphical form below:-

Stock of Dwellings by Tenure



It is not only the overall supply to the housing market which is important, but also the location and type of properties. In a non-sought after location, property prices will be low and hence also the demand for mortgages. The availability of jobs and amenities also affects house prices.

1.3 The demand for mortgages may reduce in the future, as more young people inherit property, resulting in fewer younger people requiring mortgages or young people requiring lower mortgages.

An opposing factor is the effect of remortgaging. Could it be the trend that more people are remortgaging their properties to provide them with money to use for other things? It is estimated that approximately 50% of the current mortgage activity is in remortgages. Also, inheritors of properties may buy second properties (possibly outside the UK).

The Government can have a great effect on the demand for mortgages by changing the rules as to the amount of tax relief given or manipulating interest rates. This was seen just before August 1988, when dual tax relief was being abolished and the demand for mortgages rose considerably. In many cases the decision to buy or move was brought forward due to this change in law, and was one factor underlying the lack of activity in 1989.

1.4 The supply of mortgage finance varies as different lenders want to come into the market.

The table below shows the source of mortgage or loan, by head of household, in 1986.

Great Britain — Percentages and numbers

	Age of head of household					
	Under 25	25–29	30–44	45–59	60 and over	All households
Source of mortgage or loan *(percentages)*						
Building society	*88*	*86*	*81*	*75*	*67*	*80*
Local authority	*2*	*2*	*4*	*9*	*20*	*6*
Insurance company	*4*	*3*	*3*	*5*	*4*	*4*
Bank	*6*	*9*	*12*	*11*	*5*	*11*
Other source	*1*	*1*	*2*	*1*	*4*	*1*
Sample size (= 100%)[1] (numbers)	157	516	1,909	1,027	223	3,832

1 Because mortgages or loans can be raised from more than one source, the sum of the percentages may exceed 100 per cent.

Source General Household Survey

2) What is the future of the Building Societies?

A few years ago, nearly all domestic property lending was by Building Societies. However, recent times have seen other players entering the domestic lending market.

Looking at the present and into the future, the takeovers, mergers and acquisitions and conversions to banks all have their effect on Building Societies.

How will the growth of alternative funding sources such as wholesale funding and securitization affect the survival of Building Societies? But also, how will the situation of the Building Societies affect the overall mortgage market?

Currently, Building Societies have a very "caring" image in comparison with banks and insurance companies, but how will this change in the future? If alternative lending can be provided more cheaply, then how far will this "caring" image have an effect?

Traditionally Building Societies have been able to lend at competitive rates as they have a large source of cheap finance, namely depositors' savings. This is still so, but may change in the future, as other financial institutions come up with attractive packages for depositors.

Further changes that may have an effect are the abolition of the composite rate of tax payable on Building Society interest, which may make Building Societies less attractive relative to their competitors for tax payers, and the introduction of Tax Exempt Special Savings Accounts (TESSAs).

3) What is the future of MIG? How will it develop?

Changing levels of lending in terms of loan to value ratios (eg due to inheriting wealth) will affect the premium income from MIG policies. If the average loan to value ratio drops significantly, then to what extent will the premium rating structure need to be changed to cater for expense contributions etc?

Higher numbers of remortgages will increase the demand for MIG, if remortgages are required in the relevant loan to value band. However, it is thought that an increasing number of top up mortgages are taken out without any corresponding guarantee protection, although often the risk is covered by charging a higher rate of interest.

Changes in lenders' practice may reduce the demand for MIG. For example, at least one Building Society charges a higher interest rate on the loan for a period instead of charging an MIG premium. Other lenders may in the future consider charging less standardised interest rates as a substitute for MIG insurance. Theoretically, the present value of the additional interest payments should equal the amount of the MIG premium.

If borrowers are required to take out creditor insurance, or if credit protection is packaged with MIG, this should reduce the number of MIG claims which arise as a result of sickness or unemployment, and the changes in the risk would need to be reflected in the rates charged for the MIG. There may be a growth in such packaged insurance products in the future.

Mortgage guarantee policies are currently rated in bands of loan to value ratios from 75% to 100% in 5% bands (often with 75%-90% at the same rate). As a result of lenders keeping the information and the insurers selling the policies, there is usually little relevant statistical information available. It is likely that very few companies are able to analyse their experience by loan to value ratio, even to see if the premium rating structure is correct. With more data available from the lenders, in the future more complex rating may be applied. With competition from other sources, there is likely to be a move to much more complex rating structures in the future and building societies will have to start collecting the information required if they want to obtain competitive rates from insurers.

Below are set out what could be important rating factors regarding ability to pay, but, without better information, their effect is difficult to quantify.

- occupation
- loan as a multiple of salary
- earnings prospects.

Lesser factors may be sex, marital status and other attributes which may be regarded as discriminatory.

Also, how should second mortgages be dealt with? The existence of a second mortgage is likely to reduce the funds available to enable payment to be made on either loan.

4) What is the effect of new mortgage products?

Many new mortgage products are coming on to the market, many of which the current MIG is not designed to cope with.

Changes in underwriting/lending criteria are likely to affect the experience of the MIG (eg increasing maximum multiple of salary from 3 to 4 times), but to what extent are the insurers made aware of any changes made by the lenders? And how should rates be determined when the same MIG product is used for a variety of lenders? This may be dealt with by changing the commission rate payable to the lender.

New products such as low start loans are likely to result in higher claim amounts for MIG claims because of the added accrued interest (although the incidence of risk should be reduced in the earlier years). MIG rates need to be tailored to cope with this. In addition, often life insurance premiums are rolled up into the outstanding loan, adding further to the debt.

The incidence of claims can be affected by the nature of the mortgage product also (in addition to the effect of the interest roll-up on claim amounts). In the case of low start and/or roll-up of premiums, there are likely to be fewer claims in the first few years, when the repayments are lower, but once the interest rate is increased to the normal rate, there is likely to be an influx of claims. In such cases, it would be necessary to attempt to change the earned premium pattern.

There is also an increase in foreign currency and ECU mortgages. If these were to be covered by MIG policies, factors such as variability of currency and interest rate fluctuations would come into play.

On loan to value ratio, some lenders will lend more than 100% of value. MIG rates do not currently cater for this in general.

In current times, lenders are always trying to find new ways to lend. Most of these will not be compatible with the guarantee given by a traditional MIG policy.

At the end of the day, it is necessary to assess whether the issues above are short or long term phenomena - or are we just in a part of a cycle? Also, can insurers keep pace with innovation in the mortgage market?

II. ACCOUNTING, TAX, AND RESERVING

In this section we consider:

- How should MIG be accounted for - in the absence of accounting and taxation constraints?
- How should companies reserve for MIG?
- What techniques should be used?
- What changes in accounting rules are likely or desirable?

Rationale

MIG business is unusual as exposure extends way beyond one year. It does not therefore easily fit in with the current tax and accounting environment. This section discusses the existing accounting treatment of MIG and ways in which the normal accounting rules could be adapted for MIG. It includes a discussion of the recent Insurance Companies (Credit Insurance) Regulations 1990 and their effect on accounting for MIG.

Different Types of Accounts

There are several different types of accounts, intended for the consumption of different interest groups:

Companies Act report and accounts
Statutory returns to the DTI
Tax accounts
Management accounts

Because they all have different purposes, different considerations apply for these different types of accounts.

Companies Act Report and Accounts

These are intended for those who have provided, or may in future provide, the capital of the company - that is, the existing and potential shareholders. The intention of these accounts is to show how the capital has been used, to record the income and outgo over an accounting period, the assets and the liabilities at a point of time, and generally to show a so-called true and fair view of the company.

These accounts identify and measure in aggregate the company's profits within a given accounting period, and its assets and liabilities at a point of time. Companies Act accounts deal with everything on the basis of the accounting period rather than by reference to underwriting or exposure periods.

While some companies may provide more than the minimum information in their accounts, there is in general no separate identification of business written or exposed in different periods, no separate identification of different types of business, no separate identification of inwards business and outwards reinsurance, and no separate identification of business from different territories or in different currencies.

The ABI's SORP on accounting for insurance business specifies that inwards and reinsurance business should be accounted separately, and gross premiums should be analysed into principal classes of business and geographical areas, but many companies do not follow the SORP. In any case there is no separate identification of profits from particular groups of business.

The directors' report may, however, include comments on these matters to explain the overall result. For example there may be reference to reserve strengthening on prior years' business or comments on extraordinary factors.

It is unlikely that the amount of detail disclosed will increase, so the effect of any changes in the accounting of MIG alone will not be apparent from the published accounts. However, companies may show the statutory MIG equalisation reserve separately in published accounts (see below).

Traditional Accounting

Traditional UK accounting methodology shows balance sheet reserves made up of provisions for the following items (in the case of 1-year accounting):

- reported outstanding claims (including reserves for deficiencies in individual case estimates),
- incurred but not reported claims (which may be included in the provision for outstanding claims), and
- unearned premiums and any additional reserve for unexpired risks.

The revenue account profit is the income (inward premiums net of commission and reinsurance plus investment earnings) less outgo (claims payments net of reinsurance recoveries plus expenses) plus or minus changes in year-end balance sheet reserves.

For MIG, IBNR is confined to claims in the course of being processed by the lender, since there is no claim until the property is sold, and the claim amount can then be determined. Pipeline or potential claims are a grey area, but they may be estimated in a similar way to pipeline premiums (estimates of renewals). The real difficulty with MIG accounting is the estimation of the reserve for unearned premiums and unexpired risks.

In the case of 3-year accounting, the reserves simply consist of the fund (premiums received less claims paid) for the open years (possibly augmented where an underwriting loss is contemplated) together with a combined reserve for outstanding claims and unexpired risks for the closed years. The revenue account profit or loss is simply the amount transferred out of or into the fund at the year end.

Value Added Accounting

A topical debate within the insurance industry is the basis for measuring and attributing profits and stating the assets and liabilities of a company. The traditional form of accounting, described very briefly above, shows the profit (this term is intended to include a loss as well) which arises during the accounting period.

There is also 'value added' accounting which is intended to show the increase in the value of the company through the business it has taken on during the accounting period. There are arguments on both sides concerning the matching of the incidence of effort and risk to the recognition of profit. It is not the purpose of this paper to go into this debate, except to note that these two forms of accounting each have their own followings.

As regards MIG business, it is unlike most non-life business in having a potential exposure period which is very long in comparison to the accounting period. If a realistic pattern of earned premiums is used (by which we mean one which closely represents the relative proportions of claim amounts in the various exposure periods of a cohort of policies), then the traditional 1-year accounting basis provides a significant deferral of the recognition of underwriting profits or losses.

Since, under the value added accounting method, this profit or loss is (or should be) capitalized as the present value of all estimated future cash flows, there can be a very great deal of difference between the traditional profit arising during an accounting period and the value added profit.

A small but increasing number of companies are now showing value added accounts in addition to or instead of the traditional accounts in respect of their life business. We believe this trend will continue and spread to non-life business, at least to some extent. For most classes of business this would simply mean discounting the technical reserves and allocating investment income among the shareholders' funds and the various classes and cohorts of business. It is arguable whether there should be any allowance for renewals of existing policies or, as in MIG and other block business, the continuation of new policies from existing sources. However, for MIG business, it would mean projecting the claim experience over a much longer period than for other classes, and the level of uncertainty in this is likely to be considered too high.

It may be noted that, for MIG business, if a catastrophe occurs, and a particular year of account experiences an accumulation of claims relating to various years of writing, then, under the value added method, the resultant loss will have to be set against the current year of writing, since the results for those earlier years will already have been anticipated. This effect could of course be mitigated by the use of equalisation reserves.

A 3-year funded basis, in conjunction with discounted reserves, is a possible compromise between the two approaches.

Statutory Returns to the DTI

These are intended to form one aspect of the regulation of the insurance industry by the DTI, on behalf of the consumers of insurance - the policyholders. The DTI returns force companies to maintain records in a minimum level of detail and to publish this information.

This increases the possibility of informed comment by independent third parties. While it is impossible to arrive at a conclusive judgement of a company from its DTI returns alone, they do give a tremendously better picture than the very limited information in the Companies Act accounts.

DTI Risk Groups

A survey of the 10 top UK insurance companies' recent (1987 and 1988) DTI returns (Forms 31 and 33) shows that four companies (see below) identified contract guarantees and bonds - presumably covering mortgage indemnity guarantee - as a separate risk group within the pecuniary loss accounting class. Any other companies which write MIG include it in a miscellaneous risk group.

Because of the long-term nature of MIG it seems appropriate to identify it as a separate risk group. The DTI now insists that private motor is split between comprehensive and non-comprehensive, and we can see equally valid reasons for segregating MIG business from shorter term pecuniary loss business. In fact the DTI does now require credit insurance to be accounted separately. Although separate Forms 31 and 33 are not specifically required for credit insurance, we believe companies are likely to produce them anyway. Despite this, for most insurers the financial significance of MIG business is relatively low compared with their other classes of business.

Earned premium patterns

The Form 31 ratios of exposed to written premiums for risks incepted in the financial year were as follows:

Eagle Star	6%
CIS	0%
GRE	16%
Legal & General	4%
Sun Alliance	15%

All figures except those for Legal & General were taken from the risk group 'Contract Guarantees and Bonds'. Legal & General's figures were taken from their risk group 'Other Pecuniary Loss': the low value in the table suggests that this risk group is predominantly mortgage indemnity guarantee business.

The practice in some companies (for example Eagle Star and CIS) is to spread the earning of commission according to the same pattern as that for net premiums. We do not know the treatment of commission in all companies, and if a different treatment is used for commission and net premiums then the variations in the above table could be due to this. For example, GRE's 16% could be made up of 10% commission, assumed all earned in the first year, together with 6% first year's risk exposure.

Alternatively the high values for GRE and Sun Alliance could be due to the presence of much shorter term contracts, or they could reflect the use of a simplified pattern of earned premiums of approximately 1/7th each year for 7 years. We understand that some companies use such a simplified basis. We hope that this paper will help to encourage the use of a more appropriate basis for unearned premium reserves in those companies which at present use a rough and ready approach.

Tax Accounts

The purpose of these is to agree with the Inland Revenue (in the UK) and other tax authorities (outside the UK) the tax bill(s) of the company, on the appropriate tax basis. These accounts are based on the Companies Act accounts but are not themselves publicly available.

The tax authorities would need to be convinced of any changes in the basis for recognizing profits which affected the tax computation. We think it very unlikely that there will be any changes to the basis of taxation, although discounted claims reserves have been a favourite for pre-Budget speculation for many years. It would be illogical (though not necessarily out of the question) to introduce taxation based on anticipation of investment profits without also allowing for anticipation of underwriting losses.

Management Accounts

These are internal records which the managers of the company keep in order to run the business as they see fit. They are therefore much more detailed than other forms of accounts. The records contain information which most managements regard as commercially sensitive, so remain confidential to management and professional advisers, and therefore unpublished.

We believe that MIG business should be segregated from other business because of its peculiar characteristics. It is not known how all companies treat MIG, but we believe that most are already keeping MIG separate.

To perform their function effectively, managers need regular feedback on the outcome of their actions. The accounting period is a somewhat artificial concept, brought about by the desire for regular reporting. For published accounts, a year is reckoned to be suitable, but for internal purposes monthly reports are desirable.

It is also important to segregate business written not only at different times but also at different premium rates. MIG premium rates have not changed very frequently, probably because the exposure base for the rates and the cost of claims are linked by similar inflationary factors. However when the rates have changed, their structure has changed quite markedly.

Management accounts need to be structured so that it is possible to estimate the ultimate result of a block of business as quickly as possible. Then, any corrective action that is deemed necessary can be taken. This could include changes in rates, underwriting, claims handling or general administration procedures, or withdrawing from the business altogether. The definition of a block of business includes identification of risk/rating factors such as source of business (building society) or geographical location of risks.

Claim Emergence Model

One way of estimating the ultimate result is to establish a model of claim emergence from a given cohort of business. The model should indicate the expected cost of claims at any point of time, together with ranges representing the variability inherent in the experience. Comparison of actual against expected experience would provide evidence of a final profit being in accordance with previous assumptions, or not as the case may be. This comparison is subject to some difficulties because of the possibility of pipeline claims which have not yet been reported.

The claim emergence model could be based on a simple chain ladder approach, or could be more sophisticated, involving economic forecasts of the factors involved in the future claim experience. However economic forecasting is notoriously difficult, particularly over the period of at least seven years which would be required for mortgage-related business.

Effect of Inflation

As has been mentioned already, the effect of inflation on the frequency and severity of claims is different in MIG from that of almost every other class of non-life business. High inflation of house prices should reduce both the frequency and the severity of claims.

Availability of Statistics

Any model has to make some assumptions about the composition of the portfolio, both initially and as it develops over a period of time. As has been said before, traditionally the lenders have provided very little information to the insurers - though it is believed that the more sophisticated lenders, mainly the new entrants to the mortgage market, do keep detailed statistics on their book of loans.

Ideally, a knowledge of the composition of the portfolio of risks at any point of time, including up to date estimates of the market values of properties and the amounts of mortgage arrears, would enable a better projection to be made of future loss costs.

Incidence of Risk

The incidence of the risk is difficult to identify. It can be thought of as a combination of a 'normal' attrition risk - such as divorce or illness which are not related to the circumstances of the general economy - and an 'economic' risk. The premium charged needs to cover both types of risk.

The normal risk may be relatively stable and predictable. This would be where a few borrowers get into financial difficulties because of their personal circumstances. This can be considered the 'development year' risk, and past patterns may be of most value in assessing this risk and establishing earned premium patterns.

The economic factor is likely to be a cyclical feature. Analysis of development triangles will probably be of little help in assessing this 'financial year' risk. This risk is in the nature of a catastrophe risk, and could be dealt with in the accounts by a claims equalisation reserve to pool the losses of a number of underwriting periods. In effect the catastrophe element of the premium is earned over a much longer period than the normal element.

Equalisation Reserves :
The Insurance Companies (Credit Insurance) Regulations 1990

It is believed that UK companies do not establish equalisation reserves for MIG business, even internally. There is no reason why they should not, although the current tax regime does nothing to encourage the deferment of profit in this way.

The idea of equalisation or catastrophe reserves is not unique to MIG business. Companies would presumably welcome the tax relief - if it were available - on equalisation reserves, although on the other hand it would limit the disclosed profits which might hinder their dividend policies.

The Insurance Companies (Credit Insurance) Regulations 1990 came into force on 1 July 1990. They were brought in to implement the EC Directive on Credit and Suretyship Insurance (87/343/EEC). The effect of the regulations is to oblige insurers transacting credit insurance to establish equalisation reserves to provide for above average fluctuations in claims and to maintain a higher minimum guarantee fund. The equalisation reserves are to be maintained in accordance with one of four specified methods (at the option of the insurer). The regulations are believed to be the first regulations to impose equalisation reserves on UK insurers.

It is here assumed that MIG business does come within the scope of the regulations, since it is "insurance against risks of loss to the persons insured arising from ..... the failure ..... of debtors of theirs to pay their debts when due", and therefore authorised under class 14.

The regulations exempt insurers whose credit business is below a specified threshold from the requirement to hold the higher minimum guarantee fund and an equalisation reserve. However, all credit insurers must (from 1 July 1990) include in their DTI returns information on the technical results and technical reserves of their credit insurance business. Form 15 has been amended for this purpose and Forms 29A and 29B have been introduced (depending on whether 1-year or 3-year accounting is used). Rules for how the reserve is to be calculated, built up, and used are specified in the regulations (four methods). Similar rules would be required if tax relief were to be given. Whether tax relief will be given is not yet clear. The equalisation reserve is an additional technical provision, while the higher minimum guarantee fund is an allocation of shareholders' funds. At present, as a general rule, technical provisions receive tax relief but the statutory minimum solvency margin and guarantee fund do not.

Equalisation Reserves : The Four Methods

Method 1

The equalisation reserve is built up by annual contributions of the lower of 75% of the technical surplus for the year and 12% of premiums received in the year. Contributions to the equalisation reserve stop when the reserve reaches 150% of the highest annual premiums received over the previous five years. Any technical deficit in a year is charged in full to the equalisation reserve. No limit on this charge is set in the regulations.

Method 2

Here the equalisation reserve is built up by annual contributions of 75% of the technical surplus for the year (in this case with no limit imposed by premiums received in the year). Contributions to the equalisation reserve stop when the reserve reaches 134% of the average (rather than the highest) annual premiums received over the previous five years. Any technical deficit in a year is charged in full to the equalisation reserve. Again, no limit on this charge is set in the regulations.

Method 3

Here the insurer must calculate an average and a standard deviation for its claim ratio to earned premiums over a reference period of between 15 and 30 years, based on its own experience. Presumably the reference period can be chosen by the insurer. The required equalisation reserve for any financial year is calculated at six times the standard deviation of the earned claims ratio multiplied by the earned premiums for the year.

While the equalisation reserve is below this level, transfers to the equalisation reserve must be made of 3.5% of the required level. After any such transfer into the equalisation reserve, there are then loss-sensitive transfers to or from the equalisation reserve. These are equal to the shortfall or excess (as the case may be) of the actual claims below (or above) the expected claims (that is, the product of the average earned claims ratio and the earned premiums for the year). For transfers to the equalisation reserve, there is an upper limit so that the required level of the equalisation reserve is not exceeded. For transfers from the equalisation reserve, there is no upper limit (except that the equalisation reserve presumably cannot be negative).

If an underwriting loss has never been made during the reference period used to calculate the average and standard deviation of the claim ratio, no equalisation reserve will be necessary. The required equalisation reserve and the transfers from it (but not to it) may be reduced if the average claims ratio and the expense ratio (presumably the current expense ratio) indicate a safety margin in the premiums. The regulations do not specify the reductions involved.

Method 4

Here again the insurer must calculate an average and a standard deviation for its claim ratio to earned premiums over a reference period of between 15 and 30 years, based on its own experience. As for Method 3, the required equalisation reserve for any financial year is calculated at six times the standard deviation of the earned claims ratio multiplied by the earned premiums for the year.

While the equalisation reserve is below this level, transfers to the equalisation reserve must be made whenever there is a shortfall of actual claims below the expected claims (see under Method 3). Transfers to the equalisation reserve must be equal to the shortfall of claims, but subject to an upper limit so that the required level of the equalisation reserve is not exceeded.

Whenever there is an excess of actual claims above expected claims, transfers from the equalisation reserve must be made, equal to the excess of claims but subject to an upper limit so that the transfers cannot be made out of the equalisation reserve to bring it below the minimum level (equal to half the maximum required level).

Again, if an underwriting loss has never been made during the reference period used to calculate the average and standard deviation of the claim ratio, no equalisation reserve will be necessary. The required equalisation reserve and the transfers from it and to it may be reduced if the average claims ratio and the expense ratio (presumably the current expense ratio) indicate a safety margin in the premiums. The regulations specify that the safety margin must be at least 1.5 standard deviations and the reduction factor is the ratio of 1.5 standard deviations to the actual safety margin.

General Comments

The options are clearly in pairs: Methods 1 and 2, and Methods 3 and 4. The reasons for the variations of method within each pair are not obvious, but possibly they are designed to cater for particular circumstances.

Why should insurance companies have a choice of method? Without adequate experience, a company could not use Methods 3 or 4, and these are presumably regarded as better methods than Methods 1 and 2. In due course, a company could build up enough experience to use Methods 3 or 4. Could the company change methods in mid stream? If so, what rules would there be (if any) for transferring from one method to another?

The regulations specify the transfers which must be made while the equalisation reserve is below the required amount and when there is an excess of claims. The regulations do not say whether transfers to the equalisation reserve may be higher than those specified if a company wishes to build up the reserve faster.

Moreover, suppose the equalisation reserve brought forward is greater than the required amount for the year and there is a claims shortfall so that no transfer from the equalisation reserve is needed. Presumably a company may (but need not?) transfer funds out of the equalisation reserve for general use provided the reserve does not fall below the required amount.

Aussie Rules Equalisation Reserves

Other countries have equalisation reserves - such as Finland, West Germany, and Australia. The rules for Australia in respect of MIG are as follows:

The minimum solvency margin in respect of MIG business is 2% of the aggregate risk exposed. The aggregate risk exposed is calculated as the sum, for contracts written in the last 20 years and still in force, of the excess of the amounts borrowed over 66.7% of value (residential property) or 60% of value (commercial property).

The equalisation reserve is built up and drawn upon as follows:

- Each year 25% of earned premium is transferred to the equalisation reserve.
- For any year, if claims incurred exceed 35% of earned premium, the excess may be drawn down.
- After the above transfers have taken place, the amount transferred to the reserve 10 years previously may be drawn down for general use. However, this is subject to the extent to which it has been depleted by previous drawings down (which operate on a first in first out basis).

Release of Profits

Neither the shareholders nor the tax authorities would be keen on an accounting basis which tied up shareholders' capital or deferred the tax revenue for too long a period. The profits from a given cohort of business should therefore be computed as soon as they can be determined with sufficient certainty.

'Sufficient certainty' depends on the circumstances of the company. If a company writes predominantly MIG business then revisions of past estimates of profits could be a material factor in its current year's profits. So it will wish to delay the recognition of profits compared with a large company which only writes a small amount of MIG business.

Investment Income

The treatment of investment income depends on the attitude taken to the 'profits arising' vs 'value added' theories of accounting. Under the profits arising theory, investment income should only be recognized once it has actually become receivable. But the value added theory anticipates the investment income which is expected to flow from existing funds, allowing for the amount and timing of future cash flows.

III. FORECASTING FUTURE EXPERIENCE

This is a key area in both the determination of current premium rates and the provision for future claims.

There is no obvious relationship between the past and the future. The nature of the business is that there are likely to be a number of years with low incidence followed by a year or two of high claims. However, there is no guarantee that this will occur in the future. It is possible that there could be a fundamental change in the housing market leading to a readjustment of house prices at a much lower level. However it is not really possible to make any definite quantification of this type of risk. It would seem best to include this in some form of contingency allowance.

Before looking at the factors that affect the potential future experience, it is necessary to consider the situation in which a Mortgage Indemnity Guarantee insurance will become payable. This can be simply expressed as the case where the proceeds from a forced sale of the house net of all associated charges do not cover the amount of the mortgage outstanding.

1) WHAT FACTORS AFFECT THE EXPERIENCE?

In this section we list the various factors that could have an impact on the experience. Many of them are inter-related and this will be considered in the following section.

(i) Divorce

The incidence of a divorce is likely to lead to the sale of the house; thus if various other factors are adverse this could result in a claim. Marital breakdown generally means one partner leaving the matrimonial home. The remaining partner's income to service the mortgage and other outgoings reduces. The other partner has to finance new accommodation so is reluctant to continue to pay the mortgage on the old house. Eventually the house may be sold but arrears may have built up.

(ii) Unemployment

Unemployment is likely to lead to an inability to service the mortgage. However, the immediate impact of this may be mitigated by a Mortgage Payment Protection Policy, although the period for which claims will be paid on unemployment is likely to be limited to a maximum of around two years. In addition, the DSS may pay interest on mortgages in the cases of unemployment. However, this is strictly restricted to interest payments so that in the case of a repayment mortgage no payment of outstanding capital would be made. The possible impact on the Mortgage Indemnity Policy will be dependent upon how long the unemployment lasts. Consequently re-employment prospects are crucial. These prospects will be dependent on such factors as age, location, skills etc.

(iii) Interest rate changes

Increases in interest rates may lead to inability to service the loan at the new high interest rates, especially for recent mortgages where money is usually tighter.

(iv) Sickness and accidents

The impact on the ability to service the mortgage may be mitigated by the existence of external insurances, eg PHI or Creditor protection, and by any DSS benefits payable.

(v) House prices

Really this is one of the major determinants of whether a claim will arise for even if all the other factors lead to a sale of a house, if there has been a rapid increase in house prices it is unlikely that there will be any claim under a mortgage guarantee policy.

(vi) Real incomes

The important factor here is the real disposable income. This could be affected not only by the factors mentioned above but also by other factors such as changes in taxation or social security.

(vii) General activity in the housing market

Clearly if it is difficult to sell a house it will be more likely that a claim will be made, as the price which can be obtained will be lower than in a buoyant market.

(viii) Attitudes of lenders

This will vary from one lender to another. Some lenders may take a fairly aggressive attitude to arrears and foreclose quickly or alternatively institute remedial action quickly. Other lenders may take a more relaxed view and allow arrears to build up. Clearly the latter approach may lead to a larger number of claims under the insurance, and also to larger average claim amounts.

(ix) Underwriting control

It is virtually impossible for the insurance company to exercise any underwriting control in terms of weeding out undesirable risks. The insurer is dependant on the financial underwriting adopted by the lender. The greater the degree of financial underwriting, the more likely the mortgagor is to be able to service the loan. The financial criteria adopted by the lender are also of relevance; in particular lending multiples are important.

(x) Different types of mortgage

Different types of mortgage may well exhibit different experience. It seems reasonable to assume that there is a greater risk with deferred interest schemes especially where these schemes result in the outstanding loan increasing. Equally there is likely to be an increased risk for loans which initially offer a genuine discount on the current interest rate eg schemes for first time buyers where the initial interest rate is 1% lower for the first year. There must be some risk that in current conditions the borrower will overstretch in the expectation that by the end of the first year interest rates will have reduced.

The above gives an illustration of two different types of mortgage. In recent years, we have seen the introduction of a number of different types. Each of these different products may be expected to exhibit different experience.

2) INTERACTION OF FACTORS

A number of factors have been listed in the previous section. However, these are not independent. There is a considerable amount of inter-relation between the factors. For instance, a significant rise in interest rates may lead to one or more of the following events:

(i) fall in real house prices;
(ii) fall in real disposable incomes;
(iii) rise in unemployment;
(iv) new mortgage products;
(v) less stringent financial underwritng.

Data is available over a long period for the pure economic factors. This is summarised in the accompanying table. To illustrate the inter-relation between various factors, graphs have been drawn for some of the factors, as follows:

(i) House prices, earnings and RPI for the period since 1956;
(ii) House prices, earnings and RPI for the period since 1971;
(iii) House prices/earnings ratio for the period since 1956;
(iv) House prices, earnings and mortgage rate for the period since 1956;
(v) House prices relative to mortgage rate since 1956.

There does not appear to be a clear relationship in any of the graphs.

It could be argued that many of the factors detailed are not really factors themselves but results of a change in another major factor - the current economic climate. Thus possibly the major determinant of future experience may be the financial circumstances of the particular year. However this is extremely difficult to quantify.

An alternative approach might be to look at statistics on arrears and repossessions. Statistics are available from the Council of Mortgage Lenders. However, there are limitations to these statistics. Data are only available from 1979 onwards. The data are based on returns from the largest societies and then grossed up so that there may be inaccuracies in the figures. In addition figures for later years are estimates. There are a number of other comments about the accuracy of the data in the notes produced with the figures. An increase in arrears may lead in the future to an increase in repossessions but difficulties in selling houses may lead to deferment of the claims under the MIG policy. In fact, claims may not start appearing until there is an upward movement in the housing market.

We have talked so far about national statistics. However, in many cases, individual lenders may be stronger in particular regions. Thus, in these cases, account must be taken of any particular regional characteristics eg local population changes, employment prospects, regional house prices. The existence of a single source of employment in a significant area could be a major source of future problems. There have been some historic examples of problems eg Corby with British Steel and Aberdeen with North Sea Oil.

House Prices, Mortgage Rates, Average Earnings & Consumer Prices

Year	Average Price (All) (Houses)	Average Earnings	Inc. in RPI (%)	Average Mortgage Rate (%)	Av. House Price Increase (%)	Av. House Price/ Earnings Ratio	"Real" House Inc. (%)	"Real" House Price Index	RPI	Mortgage Index	Av. House Price Index	Average Earnings Index	RPI	Mortgage Rate rel. to RPI	House Price rel. to RPI	Mortgage Rate rel. to Earnings	RPI-Adj House Price Increase %
											<-- Index=100 in 1971 -->			<---- Index=100 in 1971 ---->			
1939										100.00							
1940				5						105.00							
1941				5						110.25							
1942				5						115.76							
1943				5						121.55							
1944				5						127.63							
1945				4.71						133.64							
1946				4						138.99							
1947				4						144.54							
1948				4						150.33							
1949				4						156.34							
1950				4						162.60							
1951				4						169.10							
1952				4.4						176.54							
1953				4.5						184.48							
1954				4.5						192.78							
1955				4.76						201.96							
1956	2230	697	4.9	5.64		3.20		96.66	100.00	213.35	36.38	39.78	59.04	63.81	61.61	94.70	
1957	2280	731	3.7	5.64	2.24	3.12	-3.22	93.45	104.90	225.38	37.19	41.72	61.94	64.28	60.06	95.30	-1.41
1958	2340	756	3.1	5.64	2.63	3.10	-2.86	90.79	108.78	238.09	38.17	43.15	64.23	65.46	59.43	97.44	-0.46
1959	2360	793	0.5	5.77	0.86	2.98	-4.66	86.57	112.15	251.83	38.50	45.26	66.22	67.16	58.14	98.25	0.35
1960	2480	849	1.1	5.81	5.08	2.92	-0.69	85.98	112.71	266.46	40.46	48.46	66.56	70.70	60.79	97.10	3.94
1961	2710	896	3.4	6.31	9.27	3.02	2.79	88.37	113.96	283.29	44.21	51.14	67.28	74.36	65.70	97.82	5.68
1962	2900	922	4.3	6.31	6.84	3.13	0.31	88.66	117.83	301.15	47.18	52.63	69.57	76.44	67.76	101.06	2.25
1963	3100	966	1.9	6.06	7.27	3.21	1.14	89.66	122.90	319.40	50.57	55.14	72.56	77.73	69.69	102.30	5.27
1964	3390	1040	3.2	6.06	9.35	3.26	3.11	92.44	125.23	338.76	55.30	59.36	73.94	80.90	74.79	100.78	5.96
1965	3740	1114	4.8	6.66	10.32	3.36	3.44	95.62	129.24	361.32	61.01	63.58	76.31	83.62	79.96	100.36	5.27
1966	4040	1187	3.9	6.98	8.02	3.40	0.97	96.55	135.44	386.54	65.91	67.75	79.87	86.36	82.41	100.75	3.97
1967	4270	1230	2.5	6.98	5.69	3.47	-1.20	95.39	140.72	413.52	69.66	70.21	83.00	87.80	83.83	104.02	3.12
1968	4650	1326	4.7	7.46	8.90	3.51	1.34	96.67	144.24	444.37	75.86	75.68	85.17	92.14	89.07	103.68	4.01
1969	4850	1430	5.4	8.06	4.30	3.39	-3.80	93.29	151.02	480.27	79.12	81.62	89.17	96.11	88.73	103.91	-1.04
1970	5190	1596	6.4	8.56	7.01	3.25	-1.46	91.94	160.15	521.40	84.67	91.04	93.96	97.86	90.08	101.15	0.57
1971	6130	1752	9.4	8.59	18.11	3.50	8.77	100.00	169.39	566.28	100.00	100.00	100.00	100.00	100.00	100.00	7.96
1972	8420	1964	7.1	8.26	37.36	4.29	28.88	128.86	185.28	613.05	137.36	112.10	109.40	98.96	125.56	96.57	28.25
1973	11120	2240	9.2	9.59	32.07	4.96	20.61	152.80	198.44	671.84	181.40	128.37	117.17	101.26	154.82	92.42	20.94
1974	11130	2659	16.1	11.05	0.09	4.19	-9.87	137.81	216.69	746.08	181.57	151.77	127.96	102.97	141.91	86.81	-13.79
1975	12119	3320	24.2	11.08	8.89	3.65	-1.98	135.08	251.86	828.75	197.70	189.50	148.66	95.82	133.08	77.23	-12.33
1976	12999	3623	16.5	11.06	7.26	3.40	-3.42	130.47	312.47	920.40	212.06	218.21	184.40	88.10	114.94	74.49	-7.93
1977	13922	4170	15.8	11.05	7.10	3.34	-3.56	125.83	364.02	1022.11	227.11	238.01	214.94	83.96	105.67	75.83	-7.51
1978	16297	4740	8.2	9.55	17.06	3.43	6.88	134.48	421.54	1119.72	265.86	271.08	248.90	79.44	106.81	72.05	8.19
1979	21047	5503	13.4	11.94	29.15	3.82	16.37	155.12	456.10	1253.42	343.34	314.10	269.31	82.19	127.49	70.47	13.89
1980	24307	6725	18	14.92	15.49	3.61	0.80	156.36	517.22	1440.43	396.53	383.86	305.39	83.29	129.84	66.27	-2.13
1981	24810	7497	11.9	14.01	2.07	3.31	-10.47	139.56	610.32	1642.23	404.73	427.91	360.36	80.48	112.31	67.77	-8.79
1982	25553	8165	8.6	13.3	2.99	3.13	-9.10	126.87	682.96	1860.65	416.86	466.04	403.25	81.48	103.37	70.50	-5.16
1983	28593	8693	4.6	11.03	11.90	3.29	0.78	127.86	741.60	2065.87	466.44	496.18	437.93	83.31	106.51	73.53	6.98
1984	30812	9447	4.9	11.84	7.76	3.26	-3.65	123.19	775.80	2310.47	502.64	539.21	468.07	88.07	109.73	75.87	2.73
1985	33188	10088	6.1	13.47	7.71	3.30	-6.08	115.94	813.81	2621.69	541.40	574.71	480.82	98.36	112.67	80.56	1.52
1986	38121	10790	3.4	12.07	14.86	3.53	2.49	119.88	863.46	2936.13	621.86	615.87	509.83	101.77	121.98	84.25	11.09
1987	44220	11648	4.1	11.61	16.00	3.80	3.93	124.69	892.82	3276.02	721.37	664.84	527.16	109.74	136.84	87.02	11.43
1988	54280	12782	4.9	11.05	22.75	4.25	10.54	137.83	936.50	3636.01	885.48	729.57	552.99	118.18	160.13	88.08	17.02
1989	62135	13932	7.7	13.46	14.47	4.46	0.89	139.06	1008.8	4127.89	1013.62	795.21	595.57	122.39	170.19	91.66	6.29

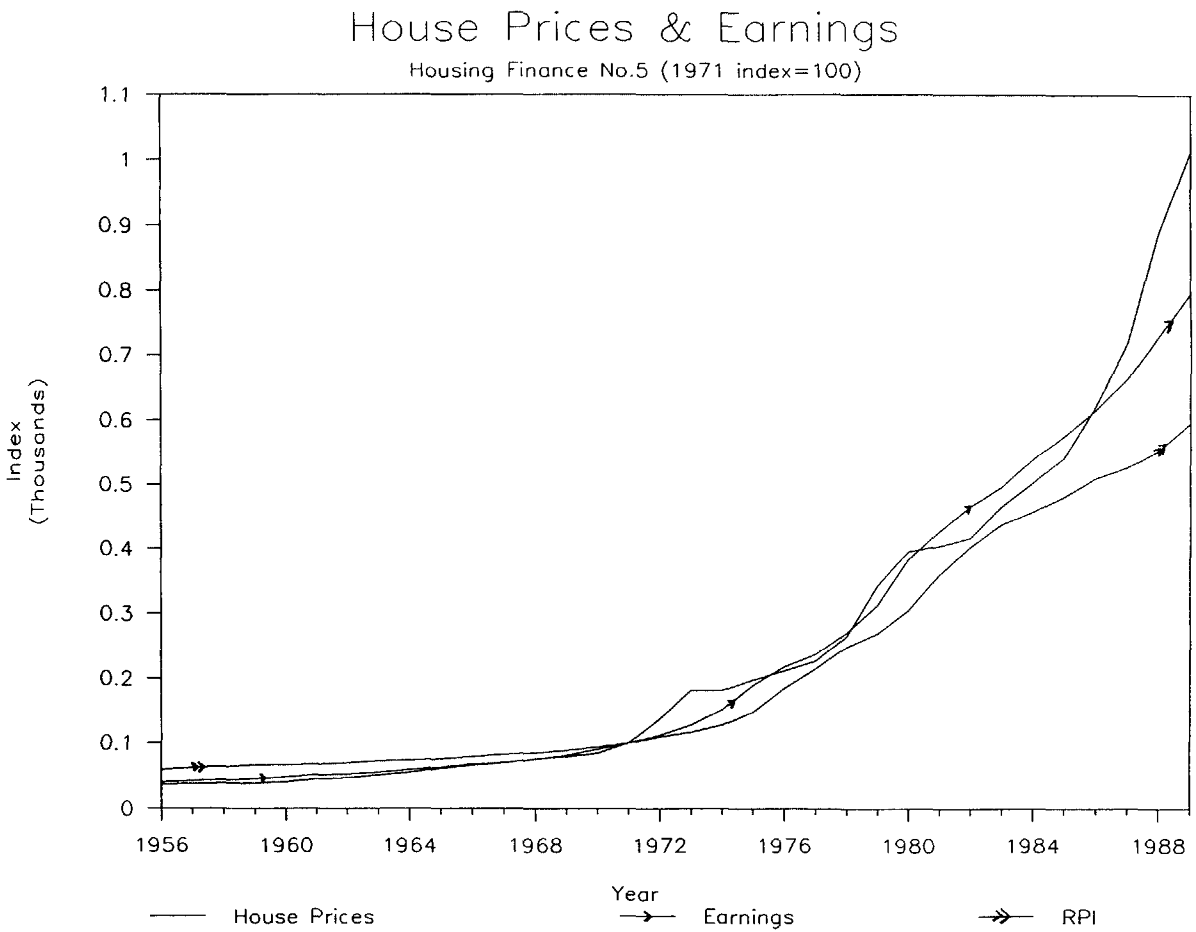
Notes

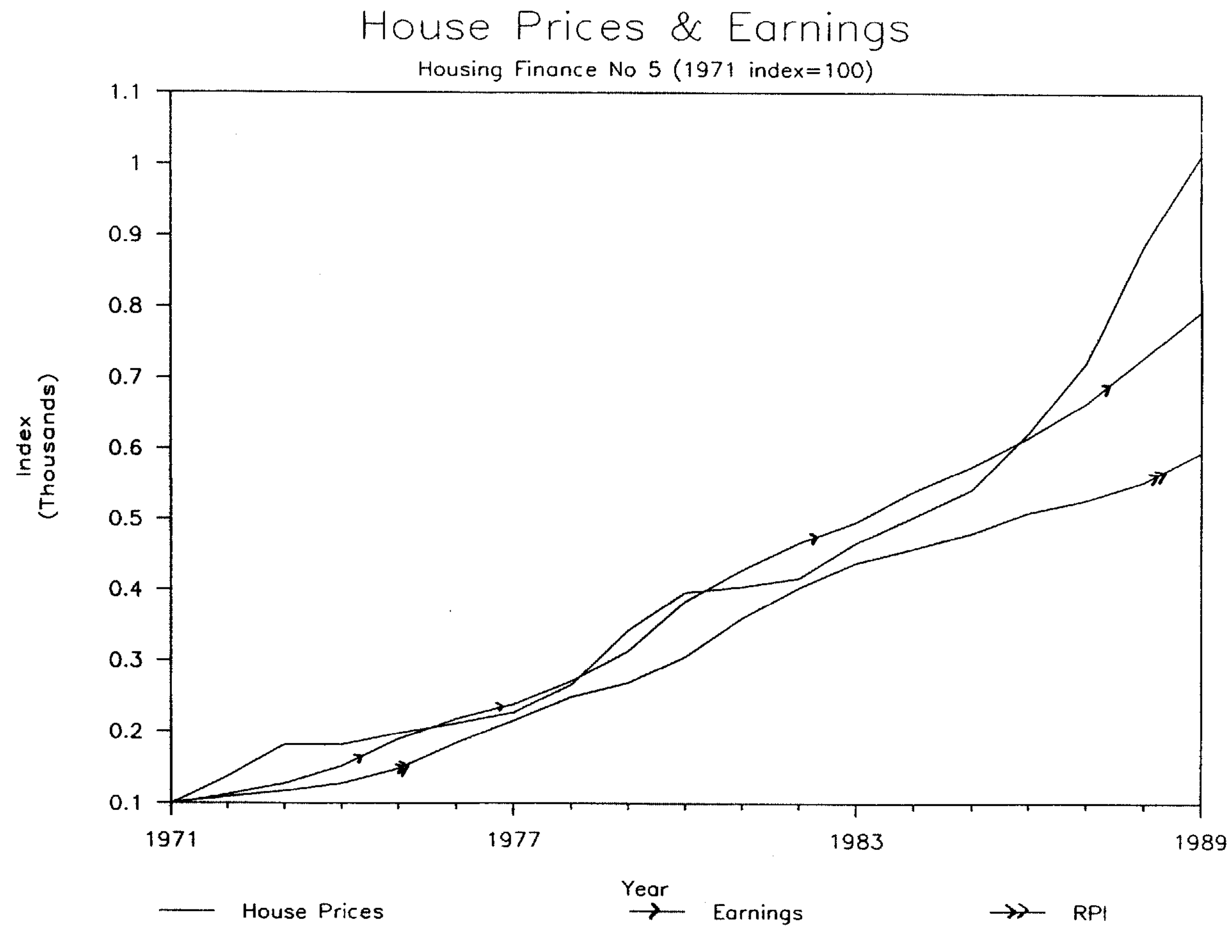
"Real" = House prices deflated by mortgage rates

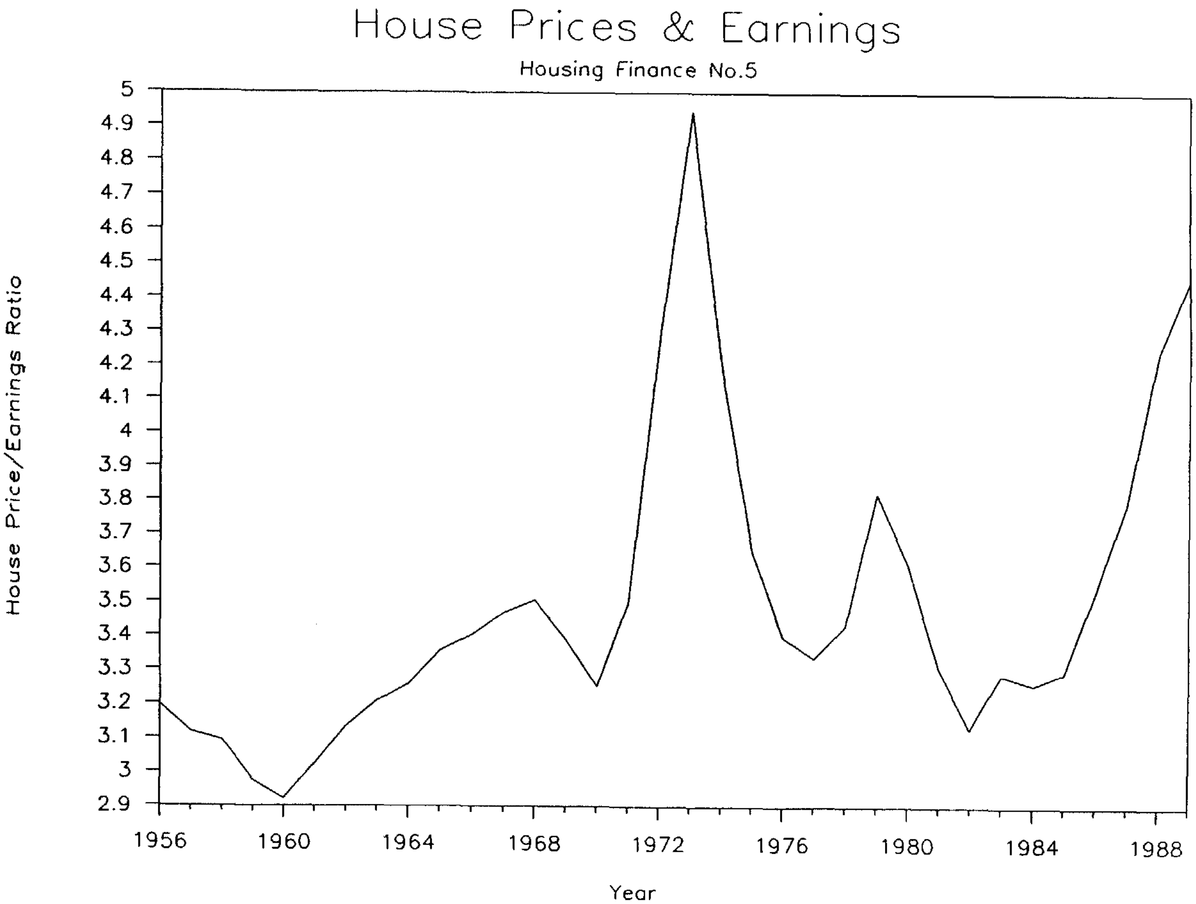
Average Price (All Houses) from Table 16 at mortgage approval stage

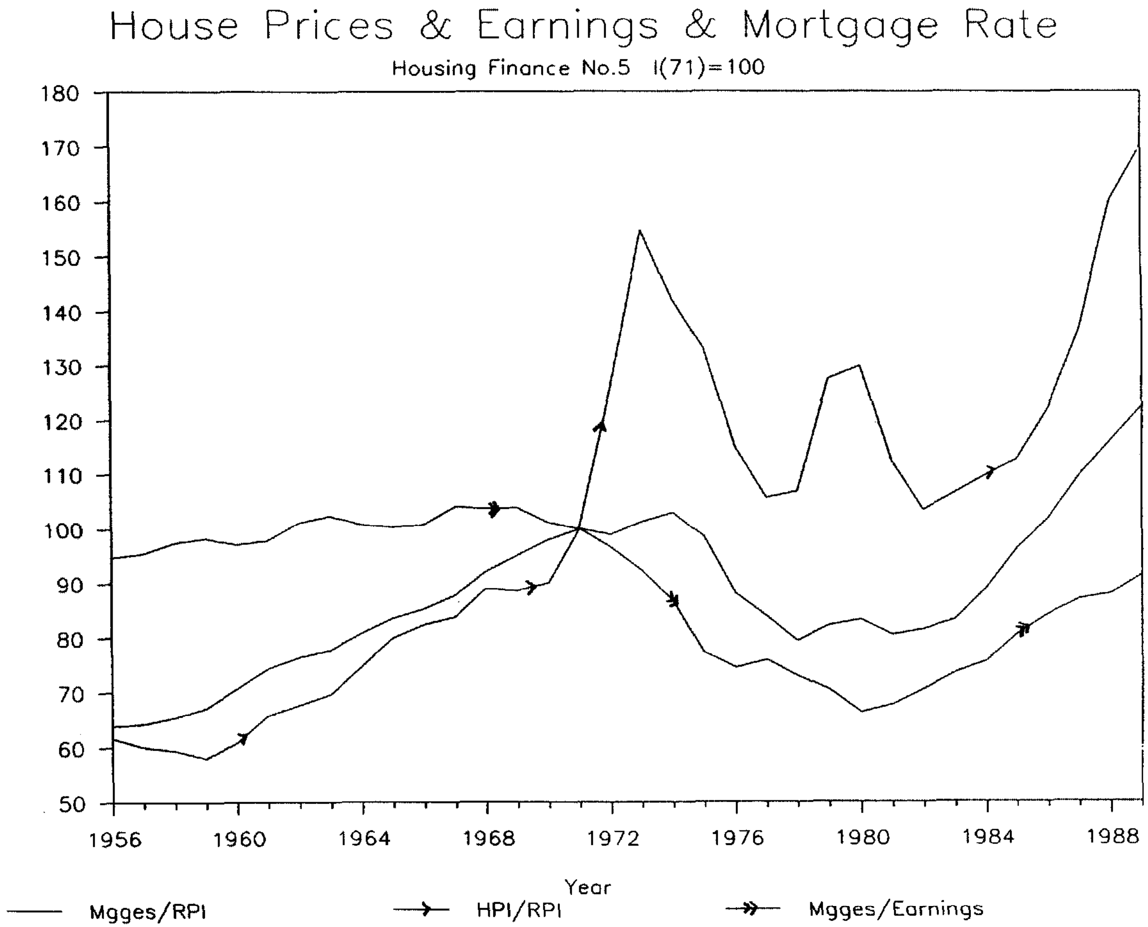
Average Earnings from Table 5 of BSA July Bulletin on House Prices & Earnings

Average mortgage rate for 1989 based on first 10 months data [source Housing Finance No. 5]


House Prices & Earnings
Housing Finance No.5 (1971 index=100)
Index
(Thousands)
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1
1.1
1956
1960
1964
1968
1972
1976
1980
1984
1988
Year
House Prices
Earnings
RPI


House Prices & Earnings
Housing Finance No 5 (1971 index=100)
Index
(Thousands)
1.1
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
1971
1977
1983
1989
Year
House Prices
Earnings
RPI


House Prices & Earnings
Housing Finance No.5
House Price/Earnings Ratio
5
4.9
4.8
4.7
4.6
4.5
4.4
4.3
4.2
4.1
4
3.9
3.8
3.7
3.6
3.5
3.4
3.3
3.2
3.1
3
2.9
1956
1960
1964
1968
1972
1976
1980
1984
1988
Year


House Prices & Earnings & Mortgage Rate
Housing Finance No.5 I(71)=100
Index
180
170
160
150
140
130
120
110
100
90
80
70
60
50
1956
1960
1964
1968
1972
1976
1980
1984
1988
Year
Mgges/RPI
HPI/RPI
Mgges/Earnings

House Prices Relative to Mortgage Rate

Housing Finance No. 5 , I(71)=100

IV. DIVERSIFICATION

1) HOW CAN THE RISK BE DIVERSIFIED?

As mentioned in earlier sections, claims under MIG can be conveniently classed as either "economic" or "normal". The former category covers losses which arise as a result of financial problems induced by rising interest rates, falling house prices, or unemployment. These are all essentially economic. One can expect these to increase in times of economic recession. The "normal" losses are those that arise as a result of divorce or sickness which might be expected to occur independently of the economic environment. Economic losses are likely to affect the whole MIG portfolio and it is against this risk that the insurer will be looking for diversification.

There are several potential avenues the MIG insurer might try to reduce the accumulation risk.

a) Product diversification
b) Geographic diversification
c) International diversification
d) Reinsurance

a) Product diversification

Additional products may be sold in conjunction with the MIG policy to reduce the exposure of the MIG to the economic loss potential. In particular the use of creditor insurance, which provides short-term relief on mortgage repayments in the event of unemployment, is likely to improve MIG experience.

The MIG may be linked with mortgages of a deferred nature in order to give the overall MIG book some staggering of exposure over time. However this may give rise to increased loss potential as the loan will also increase in value over the deferred period.

Mortgages denominated in ecus/foreign currency may help to spread the risk associated with the MIG book.

b) Geographic diversification

A good spread by region of the UK will undoubtedly reduce the chances of the total portfolio of MIG business being affected by an economic downturn. This may be achieved by restricting the proportion of the lending in any one postcode area. However, the proportion of loans requiring MIG cover will also vary by area.

c) International diversification

Whilst this does have the obvious advantage of reducing the overall susceptibility of the portfolio to the economic risk, it does necessarily entail a considerable alteration in product specifications to fit in with the very different role undertaken by MIG overseas. The table giving a brief international comparison of residential mortgage markets illustrates some of the differences.

Brief International Comparison of Residential Mortgage Market

Typical Characteristics	Country					
	UK	USA	Australia	Canada	Holland	Belgium
Mortgage Type						
Amortizing/Endowment	85% Endowment	Amortizing	Amortizing	Amortizing	50% Endowment	Amortizing
Interest:Fixed/Variable	Variable	Fixed/Variable	Variable	Fixed (25 years)	Fixed (25 years)	Fixed
Term	25 years	15 or 30 years	25 years	1/3/5 years	5/10/15/20 years	20/25 years
Interest Rate Charged directly linked to funding source?	No	Yes	No	No	No	No
Tax Incentives						
Interest Relief	first £30,000	Yes	No	No	No	No
Capital Gains Exemption	primary residence	No	Yes	primary residence	No	No
Underwriting Standards	Non-standard	Standard	Non-standard	Non-standard		standard
Forbearance of Lender	common	uncommon	common	uncommon		
Federal Insurer	No	Yes	Yes	Yes	Yes - on Town Mortgages, but limited value	No
Loan Repaid	On moving					
Comments			"Lifetime" mortgages move with borrower		MIG business in form of "Top-Up Mortgages" Charged on annual basis.	OCCH provide all loans to 70% LTV level. i.e State controlled. Loans given to 125% of house value! MIG rates apply to total loan.

Notes: Sources - S&P's International Credit Review March 28,1988

There is also an increasing economic interdependency between different countries, particularly within the EEC, which will mitigate the success of international diversification.

d) Reinsurance

In theory, stop loss reinsurance would be the most suitable form of protection against the accumulation risk. Unfortunately for insurers, this cover is generally not available, or, if it is, only at a very high price.

2) ARE THERE COMPARABLE PRODUCTS OVERSEAS?

The table on International Comparisons gives some background information on the markets (under "Comments"). It is important to recognise the differences in cover provided under the general banner of MIG-type insurance. In particular the different treatment of interest arrears, estate agency and legal fees in apportioning claims should be considered carefully when comparing different MIG contracts. For example, in the USA MIG cover is given under the title of Primary Mortgage Insurance (PMI). This cover excludes the estate agency fees, and apportions the other costs and interest arrears according to the original cover provided (see example in Appendix 3).

In the UK, mortgages are advanced to individuals using the property as security. An alternative which is practised in Denmark is for the mortgage to be attached to the property. When the property is sold the mortgage passes on to the new owner. In Australia, "lifetime" mortgages are now being advanced which attach to the individual in the sense that the mortgage moves with the individual whenever he/she moves.

These examples serve to illustrate the very different housing market backgrounds applying in different countries.

3) IS THERE AN INTERNATIONAL OR EEC FACTOR?

The international aspect has already been touched on in discussing means of diversification. Of particular concern to the UK MIG market is the increasing involvement of overseas insurers and the banking community at large in the financing of mortgage business. There have been three main spurs to this over the past eight years:

i) Ending of the monopoly of mortgage provision by building societies in 1982.

ii) Start of alternative funding arrangements to the traditional "retail" method. This began in the UK in 1987 with wholesale funding and mortgage pool securitization issues.

iii) Increasing cross-border trading within the EEC in the run up to 1992 is leading to greater interest in the UK insurance market being shown by foreign insurers (notably from France).

V. MORTGAGE POOL INSURANCES & SECURITIZATION

- MPI: What is it?
- Securitization: background & structure
- Are the capital requirements sensible?
- How should the risks on the secondary mortgage market be covered?
- Is MPI insurance or banking?

It should be appreciated from the outset that the Mortgage-Backed Securities (MBS) market is BIG, and GROWING RAPIDLY (see Appendix 4, "Miscellaneous Background Market Statistics", and the details of activity in 1989, as described in Appendix 5). The use of securitization is a means of transferring large blocks of potential future cash flow from one party (the originator) to another (the investor). It is currently the main way in which MBS are created. Insurance, in the form of Mortgage Pool Indemnity (MPI), is sometimes used to make the investment more attractive.

The MBS market provides one of basically three ways of financing mortgage business. The other ways are firstly the traditional method of raising money from the public via deposits and short-term savings, and lending this out in the form of mortgages. This may be classified as retail funding. Secondly the lending institutions may raise funds from the money markets, and this is now widely practised by Building Societies to help smooth their mortgage lending. (Up to 40% of their liabilities can be made up of this type of wholesale funding.)

MPI: What is it?

A Mortgage Pool Indemnity (MPI) applies to a pool of mortgages grouped for insurance purposes. It may be arranged in conjunction with a securitization - which will be discussed in the next section - but this is not necessarily the case.

If a mortgage lender has insufficient funds of its own available for lending, it may seek to borrow in the wholesale money market to finance further mortgage lending. This will be viable provided a sufficient margin between lending and borrowing rates of interest can be achieved. The rate of interest payable on borrowings will depend on the credit rating of the associated pool of mortgages, and so the lender will seek to enhance the credit rating of the pool in order to reduce its interest charges. This is achieved by arranging a MPI with an insurer which itself has an excellent credit rating, and is known as "rate enhancement".

The object of the MPI is to improve the security of the mortgage pool by covering potential losses arising as a result of defaults by borrowers. It thus provides a form of global protection for the pool, and operates after such MIG covers as are in force on individual mortgages. Where the pool includes loans in excess of the normal advance, these will be covered by MIG in the usual way, and in the event of default, these covers will reduce the loss to the pool which would otherwise arise.

The losses to be covered by the MPI will be of two types:

i) Losses following default on cases where the loan was below the normal advance and so no MIG cover was purchased.

ii) Normal losses on cases where MIG cover was in force but where a normal loss was also sustained, i.e. the sale proceeds were insufficient to cover the normal advance plus the outstanding interest on it.

This assumes of course that there will be no problems with the security of MIG insurers.

Securitization: Background & Structure

In general, credit securitization is the carefully structured process whereby loans and other renewable forms of credit are packaged, underwritten and sold in the form of securities.

Compared with more traditional methods of raising debt by the issue of bonds etc, credit securitization has the following advantages:-

1. It isolates the loans from the originator's balance sheet. The originator's capital is not tied up.

2. Credit securitization typically splits credit risk into three or more tranches and places it with the institutions that are in the best position to absorb it.

   The first tranche is the "expected" or "normal" rate of portfolio credit loss. This is borne by originator who has direct contact with the borrowers.

   The second tranche covers losses above the originator's limit, and is in effect the catastrophic losses. Typically a layer of 7 to 8 times expected losses is written if there are no assets backing the loans. This layer is borne by the credit enhancer (eg mortgage pool insurer) who diversifies the risk by taking a number of separate pools. The risk of loss is covered by a guarantee fee or premium. There is clearly a strong analogy with reinsurance of property and casualty business.

   The third tranche is the higher risks. These are borne by the investors purchasing the securities.

   In the UK when the loans are backed by property, the second tranche may cover all losses, and the higher risks are not borne by investors. If there were no property backing the debt, then a layering of risks should be used.

3. Credit securitization segments interest rate and mismatching risk so that it can be tailored and placed among the most appropriate investors.

   The originator absorbs no interest risk. This is sold on to the investors. Mismatch is absorbed through interest rate swaps. Prepayments are absorbed through guaranteed investment contracts.

   The cost of capital is therefore significantly reduced.

4. With credit securitization, regulators can require capital to be deployed in a way that covers risk more effectively. A substantially higher volume of debt can be raised by this approach.

5. Credit securitization permits the orderly reduction of low skilled, excess lending capacity. The weak companies who write low quality risk are theoretically underwritten out of the market.

6. Credit securitization could lead to a far more stable and less costly financial system.

A transaction in the credit securitization market may be termed a structured finance arrangement, and will have the following features:-

1) Cash flow from underlying assets is packaged to attract target investors.

2) Tax and accounting needs of both borrowers and investors are satisfied.

3) Credit criteria applied to the asset pool will generate an efficient use of funds.

4) Bankruptcy or insolvency of the originator will not interfere with the timing of proceeds from the assets in making final repayments.

The following aspects need particular consideration when setting up a structured finance arrangement:-

1) The credit rating of the asset-backed issue, which is separated from that of the originator. Typically the originator sells assets to a special purpose vehicle (SPV) to protect the investors from the bankruptcy of the originator.
   (a) Transfer must be a true sale and not a pledge.
   (b) SPV must file documents to confirm receipt.
   (c) SPV must be structured in such a way that it cannot engage in activity which would cause it to become bankrupt. There are restrictions on the purchase of assets and issue of debt. The type of SPV depends on location and law.

2) The legal form selected for the issue. It may be a trust.

3) Tax considerations.

4) Security Law considerations.

5) Accounting treatment of asset-backed issue by the originator. It must be off balance sheet.

In the US examples of types of credit which have been packed as structured finance arrangements are as follows:-

1) Mortgages.

2) Vehicle Loans.

3) Credit Card Loans.

4) Lease receivable.

5) Commercial mortgages.

6) Non-conforming residential mortgages.

7) Receivable-backed commercial paper programmes.

Securitization Issue Details in the UK

This section will consider securitization of residential mortgages only.

In the jargon potential investors are usually offered "FRNs linked to 3 month sterling LIBOR", i.e Floating Rate Notes (FRNs) linked to London Inter Bank Offered Rate (LIBOR). The rates are floating because mortgages in the UK are usually variable rate loans.

The interest rate is typically 32.5 bps / 50bps above LIBOR, meaning that the interest rate on the notes is 32.5 basis points above LIBOR (1 basis point = 0.01%) during the first seven years of the issue, rising to 50 bps above LIBOR thereafter (if it remains outstanding after 7 years). Recent issues have been made at much lower margins above LIBOR, reflecting their attractiveness from the investor's point of view.

Insurance may be used to provide security on the principal. For the investment to secure a AAA rating from the credit rating agency Standard & Poor the insurer must be of similar credit rating.

Brief details of two MBS issues are shown in Appendix 6. These illustrate two different ways of providing credit enhancement, namely by insurance (NHL First Funding Corp) and by subordinated notes (NHL Second Funding Corp).

The mortgage rate needs to be at least 75bps above LIBOR. This is needed to provide servicing of the notes (typically about 0.25% of the outstanding mortgage debt), pay the investors and the insurers, and also cover the deductible imposed on the mortgage pool by the insurer.

The attractions of MBS investment may be summarised as follows:

a) Enhanced by excellent credit ratings (mainly AAA). The perceived security of these issues is very high;

b) Declining size of the UK Gilt Market;

c) Capital Asset Requirements. This form of investment is very attractive to banks following the paper published by the Bank of England in 1988 on the implementation of Capital Adequacy Requirements (commenced February 1989). MBS holdings only attract a 50% weight (cf 100% weight for Corporate Debt) for the calculation of the 8% minimum capital adequacy standard, thereby increasing the return on capital achieved by holding MBS in preference to Corporate Debt.

   e.g holding of £10m of Corporate Debt at 15.2%, funded at 15%

capital required at 8%	800,000
return on capital	17.5%
if instead hold £20m of MBS at same rates capital required at 8% on weighted assets	800,000
return on capital	20.0%

   However it should also be noted that some banks may be obliged to offload some of their mortgage book , say using securitization, in order to increase their free capital ratio up to the 8% level.

d) Tax position. At one time their status as "Non-Corporate Bonds" allowed them to benefit from capital gains indexation as they were "non-qualifying" under the 1984 Finance Act. However subsequent to 1989 Budget this loophole has been closed off.

e) High yields are currently available on these issues.

f) The Junk Bond collapse makes the alternative corporate bond market very unattractive, especially in the US.

Potential Insurance Market

The insurance is normally on some 5-10% of the total mortgage pool, the size depending on the degree of credit enhancement required to boost the issue to a satisfactory credit rating status. A lower quality mortgage pool will require a higher level of insurance protection. The insurance premium is typically of the order of 0.35%-0.7% of the total pool value. Thus, to give some indication of the insurance market size, the total premium on the £3b of notes issued in 1988 in the UK, if they had all been insured, would have generated around £ 16 million.

There is the possibility of a potential explosion of the market. First, the banks and building societies in the UK are looking to become more capital efficient, by transferring mortgages off their balance sheets. Secondly, the US problem with their Savings & Loans debacle has necessitated a massive packaging and resale of the mortgage portfolios. It is reckoned that there is $100 billion of assets to liquidate over the next three years, and this could well result in cover being required from the insurance markets to enhance MBS issues.

Is MPI Insurance?

MBS credit enhancement can be achieved using either the banking or the insurance route. It is questionable whether the enhancement (in the form of a financial protection on the pool) counts as insurance, as it barely meets all the following criteria, which have been suggested as necessary for insurability (reference "Limits of Insurability of Risks" by Baruch Berliner).

randomness of the loss occurrence
maximum probable loss
average loss amount per occurrence
average period of time between two loss occurrences
insurance premium
moral hazard
public policy
legal restriction
cover limit

MPI suffers from losses that are not really random, but are linked to the economic environment. Whilst the members of this working party do not believe this makes the class uninsurable, it is as well to be aware of the divergent opinions held on this issue.

Banking versus Insurance : Capital requirements

It is interesting to compare the relative attractiveness to a bank and an insurer of offering the protection. The insurer has a minimum solvency requirement of, say, 18% of premium, whereas the bank has capital requirements of 8% (4% if asset-backed) of the asset value. [Incidentally, Building Societies have a minimum asset ratio of 1.2%.] The bank would receive whatever interest was offered on the subordinate loans each year it held the asset. The insurer would receive a single premium to cover essentially the same risk.

Types of Credit Enhancement

a) Pool Insured Transactions. The value depends on

1) adequacy of the level of support
2) quality of the insurer
3) timeliness of claim payments
4) defenses available to the insurer for non-payment of claims

b) Senior/Subordinated (or "A/B", "Senior/Junior") Transactions. Alternative to a). The subordinated FRNs provide the credit protection for the senior FRNs. Whilst this may not be as liquid as third party credit enhancements it will usually provide more comprehensive coverage. Also likely to be less susceptible to potential downgrade as it is more resilient and versatile.

c) Commercial Paper Transactions. Moody's believe this could start to be utilised in the future to provide mortgage funding.

Factors Affecting the Insurance Premium

There are many factors involved in assessing the required insurance premium. Many of these will also need to be considered by potential investors to any securitization issue. Appendix 7 shows the factors used by the credit rating agencies, Moodys and Standard & Poors,for their assessment. Any deviation from the benchmark set for a "prime" mortgage pool will require an appropriate adjustment to the insurance premium.

The following list is purely illustrative of kinds of adjustment that might apply

- Whether further mortgage advances & substitution are permitted

- Is there a "sweep up" facility after say 10 years to limit life of issue?

- Prepayment Rate: ie the speed at which mortgages are paid off. Experience on MPIs to date (1987-8) suggests a prepayment rate of 13%-23% p.a

The above factors will affect the expected period of exposure. A loading to the rate will be made for any significant extension of the anticipated lifetime of the pool.

- Underwriting Practices
  a) loan to income ratio (better to look at income gearing)
  b) status of borrower

- Mortgage products sold
  A loading will apply if the products are perceived as riskier such as deferred interest mortgages, or if unusually high income gearings are permitted.

- LTV profile

- Mortgage indemnity for high LTVs
  A discount might apply if an unusually high proportion of the pool is covered by MIG. This is because MIG covers the costs of repossession and sale in addition to the top slice of loan and interest.

- Deductible of the Pool
  Typically 0.5% of the total mortgage value. Higher deductibles would warrant a discount.

- Miscellaneous Catastrophe Potential. Could arise as consequence of non-economic factors e.g
  a) environmental health scares (unsafe building material say)
  b) new rail route blighting property within immediate vicinity.

The insurer would load the rate for unusually heavy concentrations of risk e.g. by location, or due to high value properties.

VI. COMMERCIAL LOSS RISKS

Commercial Loss Risks take a number of forms. There are two distinct groups:

1) Those that relate to the performance of contractual obligations in the construction of property, that is, if the contractor should fail in his obligations to build the construction, then the insurer meets the difference between the actual cost of completion of the construction and the initial expected costs.

2) Those that relate to the guarantee of the performance of a lessor in a completed property.

The first group is not included in this note. Suffice it to say that such guarantees are mainly "insured" by banks, and insurance operations who have been involved in such insurances often have tales to tell. The risk can be a political risk, and the insurer could find itself the owner of partially completed projects (eg a Lloyds syndicate owned a substantial number of partially completed construction projects in Venezuela following a coup),

The second category of risks is more akin to the MIG products, and forms a clear step in the process of development of products providing credit rating enhancement.

To explore how this market developed we need to give a few examples from the real world.

1. AIRCRAFT LEASING

The leasing of an aircraft involved transactions between a number of parties.

1) The aircraft manufacturer sold the aircraft to the leasing company.

2) To finance the purchase, the leasing company derived funds from outside third parties at a low rate of interest.

3) The leasing company leased the aircraft over a period of years to an airline.

The airline had a number of alternatives:

a) It could purchase the aircraft outright.

b) It could borrow money itself from the bank to finance the purchase.

c) It could lease the aircraft.

The option chosen depended on two factors, namely the ability of the airline to raise capital at the required interest rate, and tax breaks. Invariably the greater stability and credit rating of leasing agencies, plus the tax breaks, meant the leasing route was chosen.

At the end of the leasing period, however, the leasing company was left with an aircraft which might be of some value. The airline might have an option to purchase at a nominal amount, and so on. The whole operation therefore depended on:

a) The ability of the leasing company to find a new airline to lease the aircraft in the event of default by the initial airline.

b) The value of the aircraft at the end of the leasing period.

If one could find someone to insure such risks, then the whole transaction was not one of aircraft leasing, but of compound interest with known margins.

This lead to Residual Value Insurance (RVI) whereby the value of the aircraft at any point in time was guaranteed. This covered the risk of default, because the leasing company had the right to sell the aircraft in the event of default (or receive compensation based on the current residual value if the value of the aircraft fell below that amount).

Typical residual values started at 10% of initial purchase price after 10-15 years. The financing of such business has meant this residual value is now higher, but it should be noted that a 10 year old 747 is now worth more than the initial purchase price!

2. PROPERTY INSURANCE

This follows a similar pattern. A company wishes to raise finance in respect of a building it currently owns. This is available providing:

a) The rents raised from tenants (less other costs) exceed the interest payable on the loan.

b) The value of the property at the end of the period exceeds the amount of the loan, and, in the event of default, can be taken in lieu of a repayment.

Insurers can:
i) Guarantee the rental income (this is clearly related to the tenancy).
ii) Guarantee the residual value (again this is related to the availability of tenants).

Banks tend to take the risk up to 60%-70% of the property value, and need guarantees above this amount.

Sometimes, properties are pooled to raise money, and, in addition to the actual properties, a lien is taken on the balance sheet of the company so that the total properties against which the lien is held exceed those involved in the financing.

Areas to consider in commercial loan insurance are:

1) The quality and number of tenants.

2) The need to ensure other insurances are being maintained, or that the default is not triggered by a non-covered event.

3) The need to ensure the property is maintained to the highest standard.

4) The balance sheet of the company.

5) The spread of properties in a pooling arrangement.

Other underwriting considerations are also important, such as:

i) The local economy.

ii) The difference between the rent and the interest. What happens if the largest tenant leaves?

iii) The length of the leases. Are they to be renewed during the period?

iv) The quality of the building, with respect to new technology.

v) Whether the use of the property can be transferred.

An interesting development that has arisen recently is the extent to which brokers think that such a guarantee can be given.

a) Initially the residual value for aircraft leasing was 10%. It is now rising upwards - but it is thought not to have exceeded 70%.

b) The loan to value ratio for commercial properties was initially 50%. Loan to value ratios of 80% or higher are now considered.

c) Mortgages.

The advent of variable mortgages has meants that a LTV of 100% may be exceeded! For example, a pool of properties was to be insured so that essentially at the end of a period of 20 years their value was to have increased in line with inflation during the period.

LENDING CRITERIA

When requested by a lender to provide a quotation for their MIG insurance requirements, the insurer will require a copy of the lender's detailed lending criteria. Within such criteria reference will typically be made to the following:

- Type and nature of properties which the lender is prepared to accept as security (i.e. construction, age, usage, tenancy and geographical location).

- Maximum and minimum size of loans (including loan to valuation ratio restrictions).

- Income multiple requirements ("standard" would be 3 x prime applicant's income plus 1½ x second applicant's income or 2½ x joint applicants' income).

- Details of what may be included as income (overtime, bonuses or other additional payments) and the manner in which these may be used to establish the maximum loan available.

- Applicant status requirements. These may include the following:-

  Employer's reference/previous employer's reference
  Previous lender's reference
  Landlord's reference
  Voters' roll check
  Credit search check
  Age requirements
  Nature of employment requirements
  Production of audited accounts (self-employed applicants)

- Limits beyond which MIG insurance is required (normal advance limits).

- Appointment of valuers.

- Appointment of solicitors.

- Acceptable repayment methods (repayment, endowment, pension backed etc.)

- Minimum and maximum term of mortgage.

- Availability of remortgages and further advances.

The insurer will need to be satisfied that the criteria are prudent and that any limits which it wishes to place on its writing of MIG insurance will not be exceeded.

APPENDIX 1 (CONT'D)

MORTGAGE PRODUCT PROFILES

A lender may offer a variety of mortgage products; for each product, status requirements, income multiples, loan to value ratios, Maximum Advance and Normal Advance limits are likely to vary. It is essential therefore that the insurer has full details of all mortgage products offered for which MIG cover is sought, if details have not already been incorporated within the Lending Criteria.

The term "plain vanilla" is often used for a standard repayment, endowment or pension backed mortgage under which the lender requires "Full Status" enquiries to be completed. "Full Status" enquiries will generally incorporate all of the following status checks:

- Previous lender's or, if no previous lender, landlord's reference.
- Employer's reference, including confirmation of salary and position.
- If applicant is self-employed, production of 3 years' accounts from a qualified accountant.
- A credit search (from UAPT or CCN agency).
- A voters' roll check.

Sometimes under specially agreed schemes a lender is prepared to offer to forgo some of the "Full Status" checks in exchange for a high level of equity input from the applicant; such products are often referred to as "Semi-status", "Non Status", "Express", "Fast Track", or "High Quality" mortgages. Frequency, because of the high level of equity input by the borrower (i.e. loans restricted to 60 or 70% of valuations), MIG insurance will not be sought by the lender. However, driven by the relentless search to have the competitive edge in the market place, requests from lenders for MIG insurance in respect of such products are now becoming more common. Such requests need to be treated with caution.

In recent years a variety of "Low Start" products have been introduced by lenders. All such products work on the principle of deferring some element of mortgage repayment in the early part of the mortgage, deferred amounts being added to the principal sum at some later date. Whilst the subsequent cost of the mortgage will increase, the repayments in the early part of the mortgage will be lower. In theory therefore the debt burden upon the borrower is reduced, although often this advantage is to a certain extent eroded by the lender making available increased income multiples under such products. All such schemes require careful consideration before agreeing to write MIG cover.

New mortgage products are constantly being developed by lenders; more recent examples are mortgages which utilise Unit Trust Funds or Personal Equity Plans (PEP's) as repayment vehicles as opposed to more conventional methods such as an endowment policy.

Each new product will require careful consideration in order that the insurer can be satisfied of the viability of the proposed product and the impact the product profile is likely to have on any MIG insurance arranged in connection with it.

Specially agreed terms and rating are likely to be applied to non "plain vanilla" mortgages.

PREMIUM REFUNDS

Generally no return of premiums for cancellation of cover, i.e. early redemption of a mortgage benefiting from MIG cover, will be entertained. There will however be a number of existing insurance connections where in the past negotiations have been completed agreeing a scale of refunds or premium which may be allowed in the event of early redemption. It will be necessary therefore to refer to the Mortgage Indemnity Acceptance Authority Agreement or relevant correspondence to establish the agreed position for any specific lender. Nevertheless, the current general philosophy for new insured connections is that, unless a mortgage is redeemed within the first six months from the original date of mortgage and in addition the borrower specifically requests a refund from the lender, no rebate shall be given.

The following points demonstrate that whilst the MIG cover extends for the life of any mortgage (normally 25 years) the MIG policy is most at risk within the first 2/3 years of a mortgage and therefore any refund of premium agreed after such a period is to a large extent unjustified.

- In the early years of a mortgage the monthly payments represent a significant debt burden upon a borrower in terms of total percentage of income. In subsequent years, for the majority of borrowers, such debt burden will become lighter as a result of increases in salary (cost of living increases and/or promotion). A borrower is therefore far more likely to default within the early years of a mortgage.

- History indicates that in the long term property values increase. Such increases will be to the benefit of MIG insurers in the event of foreclosure.

- In the later years of a mortgage, the surrender value of any life contract effected as a repayment vehicle is likely to be significant and this may be available to relieve the oustanding debt.

APPENDIX 2

SPECIMEN CLAIM CALCULATIONS

Calculation A

In this case the MIG premium was £39.20, having been calculated at the rate of £2.80% on an amount of £1400.

The normal loss was nil, so no loss was suffered by the lender.

The claim amount was £2805.40, or just over twice the amount on which the premium was calculated. The costs associated with the re-possession and sale amounted to £1942.66, or 69.2% of the claim amount.

Calculation B

In this case the MIG premium was £51.48, having been calculated at the rate of £3.30% on an amount of £1560.

The normal loss was £2367.09, or 35.5% of the total deficiency.

The claim amount was £4294.88, of which the costs associated with the re-possession and sale amounted to £2249.21, or 52.4%.

In this case it appears that the property value had fallen by about £2000.

STATEMENT OF CLAIM

Actual Advance as stated in Guarantee Policy		£ 15000.25
Guarantee Premium (if debited)		£ 39.20
Plus interest on actual advance calculated from the commencement of the mortgage up to the date of completion		£ 5574.94
Plus Outgoings:-		
Litigation	£ 489.60	
Inspection fees	£ 92.00	
Repairs	£ 125.58	
Administration fees	£ 156.00	
Rates	£ -	
Ground rent/Service charges/Feu duty .	£ -	
Housebreaking Insurance	£ 50.00	
Insurance premium	£ 119.49	
Legal costs of sale	£ 520.77	
Selling commission	£ 267.37	
Advertising costs	£ 121.85	
Inventory fee	£ -	
Factor charges	£ -	
Other items	£ -	
	£ 1942.66	£ 1942.66
Less HEI claim	£ -	
		Total £ 22557.05
	£ 1942.66	
Less Repayments (All subscription and Principal Repayments from commencement of the Account but excluding amounts relating to the Combined Life Advance – ordinary subscriptions and voluntary repayments to be apportioned if necessary. N B – Exclude fines of Redemption Fees due or debited and not paid for in cash)		£ 4251.40
		£ 18305.65
Property sold for		£ 15500.25
Less Special Surrender Value		£ -
Deficiency		£ 2805.40

Deficiency	£ 2805.40
Deduct Normal Loss (if any)	£ Nil
Amount claimed for Settlement	£ 2805.40

Normal Advance (Actual advance (as shown opposite) less amount of Guarantee Policy) ...	£ 13,600.25
Plus Proportionate Interest (Calculated :- (Interest on actual advance X normal advance / Actual Advnce)	£ 5054.62
Total	£ 18654.87
Less Proportionate Repayments (Calculated :- (Repayments on actual advance X normal advance / Actual Advance)	£ 3854.60
	£ 14800.27
Property sold for	£ 15500.25
Normal Loss (if any)	£ Nil

CALCULATION A

STATEMENT OF CLAIM

Actual Advance as stated in Guarantee Policy		£ 7569.07
Guarantee Premium (if debited)		£ 51.48
Plus interest on actual advance calculated from the commencement of the mortgage up to the date of completion		£ 4918.84
Plus Outgoings:-		
Litigation	£ 186.00	
Inspection fees	£ 92.00	
Repairs	£ 180.50	
Administration fees	£ 171.00	
Rates	£ -	
Ground rent/Service charges/Feu duty .	£ -	
Housebreaking Insurance	£ 25.00	
Insurance premium	£ 305.00	
Legal costs of sale	£ 178.25	
Selling commission	£ 115.00	
Advertising costs	£ 799.81	
Inventory fee	£	
Factor charges	£	
Other items	£ 299.00	
	£ 2351.56	£ 2249.21
Less HBI claim	£ 102.35	
	Total	£ 14748.60
	£ 2249.21	
Less Repayments (All subscription and Principal Repayments from commencement of the Account but excluding amounts relating to the Combined Life Advance - ordinary subscriptions and voluntary repayments to be apportioned if necessary. N B - Exclude fines of Redemption Fees due or debited and not paid for in cash)		£ 2586.38
		£ 12162.22
Property sold for		£ 5500.25
Less Special Surrender Value		£ -
Deficiency		£ 6661.97

Normal Advance (Actual advance (as shown opposite) less amount of Guarantee Policy) ...	£ 6014.07
Plus Proportionate Interest (Calculated :- Interest on actual advance X normal advance / Actual Advance)	£ 3908.30
Total	£ 9922.37
Less Proportionate Repayments (Calculated :- Repayments on actual advance X normal advance / Actual Advance)	£ 2055.03
	£ 7867.34
Property sold for	£ 5500.25
Normal Loss (if any)	£ 2367.09

Deficiency	£ 6661.97
Deduct Normal Loss (if any)	£ 2367.09
Amount claimed for Settlement	£ 4294.88

CALCULATION B

Appendix 3 : Comparison of MIG & PMI Insurance

initial property value		100,000
loan to value		95%
insured down to		75%
loan amount		95,000
interest arrears	20%	19,000
estate agency fees	5%	4,000
other costs		9,000
total		127,000
house price fall		20%
current property value		80,000
amounts payable		127,000
originators loss exposure		(47,000)

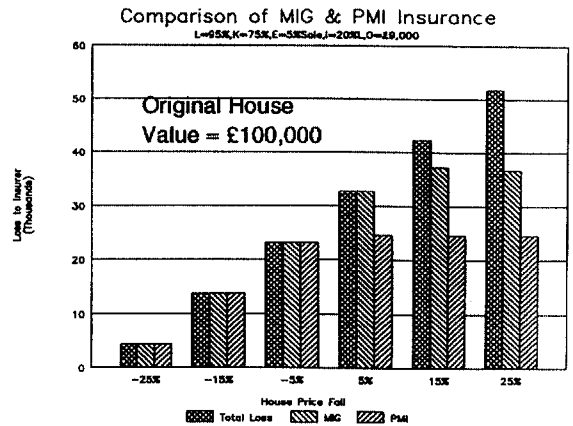
Split of Loss with MIG Insurance:

MIG Insurer	37,000
Originator	10,000

Split of Loss with PMI Insurance:

PMI Insurer	24,600
Originator	22,400

House Price Fall	Total Loss	MIG Loss	PMI Loss
-25%	4,250	4,250	4,250
-15%	13,750	13,750	13,750
-5%	23,250	23,250	23,250
5%	32,750	32,750	24,600
15%	42,250	37,250	24,600
25%	51,750	36,750	24,600



Current Market Players - Special Purpose Mortgage Companies

1. The Mortgage Corporation (TMC)
   a) owned by Salomon (American investment bank)
   b) started April 1986

2. Household Mortgage Corporation (HMC)
   a) 16 financial institutions as shareholders
   b) started July 1985
   c) obtains business through 10 life companies

3. National Home Loans Corporation (NHLC)
   a) stock market listed September 1985
   b) obtains business through panel of life companies

4. Mortgage Funding Corporation (MFC)
   a) owned by merchant bank Kleinwort Benson
   b) started June 1985
   c) purely a funding vehicle (i.e relies entirely on other institutions to originate the mortgages)
   d) securitizes mortgages for 7 mortgage originators

Miscellaneous Background Market Statistics

The first public issue of MBS (Mortgage-Backed Securities) in the UK was in 1987.

UK	
Gross Advances by Building Societies in 1988	£49.4 billion
Building Society Share of 1988 Residential Mortgages	58%
Gross public issues of MBS in 1988	£3.2 billion
Total residential mortgage loan balance at June 1989	£237 billion
USA	
Outstanding MBS at the end of 1989	$900 billion

NHL First Funding Corp. plc

Rated 'AAA'

Transaction summary

Sale date: March 3, 1987
Securities offered: £50 million mortgage-backed floating rate notes due 2013
Structure type: Mortgage-backed cash flow bonds.
Collateral: A pool of variable-rate mortgages on residential properties located in England and Wales
Dependent issues: Sun Alliance & London Insurance plc ('AAA' claims-paying ability), and Financial Security Assurance Inc. ('AAA' claims-paying ability)
Administrator/originator: National Home Loans Corp. plc.
Trustee: Chase Manhattan Bank N.A.
Lead underwriter: Salomon Brothers International Ltd.

Rationale: An 'AAA' rating is assigned to NHL First Funding Corp. plc's £50 million mortgage-backed floating rate notes due 2013. The rating is based on the underlying collateral's quality, the financing structure's legal soundness, protection against credit losses and liquidity shortfalls, and the administrator's ability to service the loans. A mortgage indemnity insurance policy ultimately provided by Sun Alliance covers those mortgages with loan-to-value ratios above 75%. Additionally, Sun Alliance provides a mortgage pool indemnity policy which covers losses resulting from defaulted mortgages. A surety bond, written by Financial Security Assurance Inc., guarantees interest payments on the notes.

Structure: Interest on the notes will be payable quarterly in arrears on the last business day in March, June, September, and December. The notes will bear interest at an annual rate of 0.20% above the London Interbank Offered Rate. The notes will be redeemed on any interest payment date, from mortgage prepayments not used to make further advances on existing loans. The notes may also be redeemed in their entirety when the aggregate principal amount outstanding falls to £10 million. On any interest payment date, the issuer may opt to redeem all of the notes upon certain changes in the tax laws. If the issuer does not redeem the notes in this instance, the investor will receive the net interest payment. Unless otherwise redeemed, the notes will be redeemed in September 2013 (at note maturity).

Collateral: The mortgage portfolio consists of 1,000 residential mortgage loans, with an aggregate principal balance of £50 million. The loans are for residential freehold and leasehold properties, including detached, semidetached, and terraced housing in England and Wales. The mortgages range from £15,000 to £250,000. The mortgages have maturities of 10 to 25 years, monthly interest payments, and scheduled principal repayment at maturity. The last mortgage will mature Sept. 30, 2011, two years prior to note maturity. Each mortgage is covered by an endowment policy, as well as the other insurance policies mentioned above.

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NHL Second Funding Corp. plc

Rated 'AAA'

Transaction summary

Sale date: Oct. 8, 1987
Securities offered: £100 million mortgage-backed series A notes due 2014.
Structure type: Senior/subordinated mortgage-backed bonds.
Collateral: A pool of variable-rate endowment residential mortgages on properties located in England and Wales.
Dependent issues: Sun Alliance & London Insurance plc ('AAA' claims-paying ability) and National Westminster Bank plc ('A-1+' short term).
Administrator/originator: National Home Loans Corp. plc.
Trustee: Chase Manhattan Bank N.A.
Lead underwriter: Morgan Guaranty Ltd.

Rationale: An 'AAA' rating is assigned to NHL Second Funding Corp. plc's £100 million mortgage-backed series A notes due 2014. The rating is based on the underlying collateral's credit quality, overcollateralization of assets, and liquidity reserve funds. The rating also addresses the financing structure's legal soundness, as well as the administrator's ability to service the loans. The cash flow from the mortgages, together with the reserve funds, will service debt on a full and timely basis. Credit loss protection is provided by £11 million subordinated B notes issued in concurrence with the rated series A notes. Additional credit loss coverage is provided by a mortgage guarantee indemnity insurance policy provided by Sun Alliance. The variable mortgage rate is set to ensure that note payments, fees, and expenses are met. The transaction accounts are held with National Westminster Bank.

Structure: Interest on the notes will be payable quarterly in arrears on the last business day in January, April, July, and October (interest payment dates). Until the interest payment date in October 1994, the notes will bear interest at a rate of 0.275% above the London Interbank Offered Rate (LIBOR). Thereafter, the rate will be 0.5% above LIBOR. Series A notes will be redeemed on the interest payment dates if the issuer receives mortgage prepayments. No series B notes will be redeemed until all series A notes are repaid. The issuer may redeem the notes in their entirety as of the interest payment date in October 1994 or when the notes' outstanding principal balance falls to £10 million. The notes may also be redeemed at the issuer's option if a withholding tax is imposed. If the issuer does not redeem the notes, the investor will receive interest payments net of the tax.

Collateral: The notes are secured by a pool of 2,600 variable-rate endowment mortgages over freehold and leasehold residential properties in England and Wales. Over 70% of the mortgages' aggregate principal balance represents properties concentrated in the southeast of England and the Greater London area. The mortgages approximate £111 million. The mortgages' maturities range from five to 25 years, with the latest maturity in 2012 (two years prior to note maturity). About 83% of the pool consists of mortgages with maturities of at least 20 years. Interest will be paid monthly. There are no scheduled principal payments prior to maturity. However, principal may be prepaid at any time, at the mortgagor's option. The mortgage interest rate is reset as often as monthly by the administrator. Mortgage loan balances range from £15,000 to £250,000, with an average balance of £42,125. Mortgages with a loan-to-value ratio above 75% are insured by a mortgage guarantee indemnity insurance policy provided by Sun Alliance.

Standard & Poor's prime pool guidelines

1. mortgage types
endowment,repayment,interest-only,and pension-linked
2. security
first charge on residential property located in England or Wales
3. property characteristics
detatched and semidetached
purpose-built and converted flats
bungalows,maisonettes,and terraced housing
freeholds and leaseholds (30 years remaining life beyond mortgage term)
vacant possession
deed or letter of consent from nonborrower adult residents
4. LTV ratios
up to 80% LTV without mortgage indemnity insurance; up to 95% LTV with insurance
5. Loan Size
£15,000-£150,000
6. Income limits
2.5 times main salary plus 1.0 times secondary salary or equivalent
7. credit checks
united association for protection of trade (UAPT) and income verification
8. regional dispersion
maximum 0.5% pool from any primary postal code designation
9. pool size
minimum 300 loans
10. valuers
royal institute of chartered surveyors (RICS) approved or equivalent by outside panels
11. homeowners' insurance
index linked to annual index and coverage of subsidence
12. limit on endowment and pension-linked policies from (credit) unrated companies
no more than 25% of the policies from any one unrated provider; maturities of the mortgages and policies are to precede the bonds by at least two years
13. term insurance
100% level term with policy assignable to lender

Nonconforming pools require an adjustment to be made to the credit loss protection calculations.

The following basic underwriting criteria would be sufficient to give the pool "prime" status (namely AAA):

1. the loans must be secured on traditionally built owner-occupied properties located in England and Wales
2. mortgage amount of between £15,000 and £250,000
3. the status of the borrower must be adequately checked
4. loans must be interest only and secured by an endowment policy (pension policies may be acceptable)

Moody's Assessment of Risk to Noteholders

This is related to the distinctive features of the UK mortgage market as they relate to mortgage pool credit risk.

Credit Quality of the Underlying Mortgages

Consider quality of the underlying mortgage collateral and the protective elements used to insulate investors from mortgage default losses. For highly rated issues the credit support must be sufficient to provide full protection under extreme economic conditions. For "benchmark credit support level" require

a) Non-amortising, interest-only mortgage loans
b) Loan size of £15,000 to £30,000
c) Secured by 1st charges on single-family, detached properties
d) Freehold properties
e) Owner-occupied, primary residence
f) Well dispersed throughout industrially diversified regions
g) No abnormally high property values
Values of financed homes consistent with the range of property values of the area in which the homes are located
h) Underwritten to industry standards
By a company with a proven track record of low arrears and default losses
i) Carrying mortgage indemnity insurance
Down to 75% for all loans in excess of 80% LTV.

This "benchmark" was developed after consideration of the UK circumstances with regard to
a) Unemployment Benefits
Unemployment highly correlated with default rates despite support provided by UB. Under attack by Conservative Government
b) Net Equity (ie 100-LTV%) and house price changes.
Serious arrears may be brought about by unemployment, marital problems, unforseen expenses or other circumstances affecting cash flow. However the decision to default rather than sell up will usually only occur if there is the likelihood of negative equity at the time of the sale. The outlook for continued house price rises is diminished by
1) proportion of owner-occupiers stabilising
2) possibility of MIRAS being eventually removed
3) speculative bubble bursting
c) Mortgage indemnity insurance
More effective than US version (PMI) as all reasonable expenses incurred in the possession and sale proceedings are covered.
d) Possession and Sale Costs
This will be affected by the length of time needed to gain possession and effect sale. The costs include
1) past-due mortgage interest payments
2) estate agent fees
3) solicitor fees
4) court fees
5) property insurance
6) general rates
7) maintenance costs
e) Time to Possession and Sale
Can take 2 or more years following initial default. Affected by
1) time to get to court (these are already overburdoned and in the event of a severe economic downturn will get more so)
2) attitude of courts, which has tended to be very sympathetic
3) lenders exercising forbearance
f) Interest-only mortgages
As these don't amortise the loan the exposure is relatively greater. 82% of new loans are of this type.
g) MIRAS
Provides some insulation to the lender as payments continue temporarily after initial default by borrower. However future for MIRAS is dim - in any case less effective as basic rate tax diminishes.

This "benchmark" should be adjusted for the following factors

a) endowment insurance policies if assigned to lender

This provides a contribution towards the loan redemption in the event of default. However this is minimal in the first couple of years. "With-Profit" policies offer better protection to lender than "unit-linked" as premiums are generally higher. Credit quality of the underlying endowment insurance company relatively unimportant as a result of the Policyholders Protection Act 1975.

b) pension-linked mortgages are not creditworthy

This is because they cannot legally be assigned - therefore the pension provider is not obliged to make payment direct to the lender.

c) capital repayment mortgages

These have not yet been securitised. Problems are caused if the mortgage repayment period is extended, following a rescheduling, as the security to the note investors is endangered if it extends beyond the FRN period.

d) Property Type

Flats and maisonettes, particularly freehold, exhibit greatest price volatility.

e) Geographical Concentration Risk

The risk depends on the diversity of the local economy. Moody's will monitor regional and postal code concentration.

f) Abnormally high Property Values

In relation to the immediate vicinity as there will then be a tendency to a longer than average selling time and greater susceptibility to house price volatility.

g) Further Advances tend to reduce credit quality

It was usual for these mortgages to be removed from the securitised pool. However this shortens life of the issue from the investors' viewpoint, which may be unpopular.

h) Loan Seasoning

Monitor repayment history and house price changes to look for signs of good/bad servicing record of mortgagors.

i) Loan Purpose

Remortgaging is likely to increase default propensity. Low income ratios, low LTV and conservative valuations by a qualified valuer will all help reduce risk.

j) Method of Setting Mortgage Interest Rates

Risk increases if rates are fixed relative to LIBOR with no discretion left to loan administrator. Further increased if SPMCs are thinly capitalised allowing them little freedom in times of high interest rates to keep rates competitive (see 4d).

k) Quality of the indemnity insurance company

The indemnity insurance provides a high level of credit risk protection: the overall credit risk therefore depends crucially on the quality of the insurer.

Structural and Legal Risks

This has regard to the payment to noteholders not being impaired by third party credit risks; namely insolvency or illiquidity.

a) Issuer Related Risks

1) Liquidity Risk

Look at potential for mismatch between inflow from mortgage repayments, scheduled interest payments and income from investment of the issuer's cash accounts in short-term instruments and outflow of investor principal and interest and the issuer's ongoing expenses (from administration, trustee and accounting).

2) Third Party Insolvency Risk

Ensure adequate protection to issuer in the event of insolvency of say the administrator. In particular ensure mortgage collateral is insulated.

3) Equitable vs. Legal Assignments

Mortgages are transferred from the originator to the issuer. Mortgages consist of 3 constituents: mortgage debt; legal mortgage on property; and the mortgage of the endowment policy. The risks are much greater if only equitably assigned as the interests of the issuer are then not apparent to the mortgagor, and the originator may fraudulantly or mistakenly transfer the mortgage to a third party as no record in the Registrar of Titles would exist. This can then result in delays and loss to the issuer. If the transfer is by equitable assignment the following considerations apply:

a> Notice Legal

Interests of issuer and trustee need to be notified to all interested parties to ensure the collateral of the mortgage is not treated as part of the estate of the originator.

b> Priority of Rights

Legal takes precedence over equitable assignments

c> Borrowers Right of Set Off

Mortgagor may offset with originator unless made aware of the transfer.

d> Direction of Mortgage Payments

Payments made to originator can only be redirected to issuer if legally assigned.

b) Administrator Related Risks

Administrator - usually the originator - handles normal servicing functions including setting interest rates, managing MIRAS and mortgage arrears, handling borrower enquiries in return for an administration fee. Look at

1) Management
2) Arrears and Collection Procedures
3) Investor Reporting
4) Past portfolio Losses and Arrears
5) Cash Reserves
6) Existence of Corporate Guarantees or Performance Bonds

Check that the following are satisfactory dealt with:

1) Transfer of Administration Responsibilities

2) Repurchase Obligations

Oblige the Administrator to repurchase mortgage loans that don't conform to representations and warranties outlined in the mortgage sale agreement as insurers providing credit enhancement will not cover them.

3) Interest Rate Subsidies

Usually provided by Administrator for marketing reasons. May jeopardise security of Administrator.

Basis Risk

This arises as a result of

a) Quarterly Note rate & Monthly Mortgage Repayment Discrepancy

b) Mortgage Prepayment Necessitating Short-Term Reinvestment

c) Increased LIBOR Spread Required After Normally 7 Years

d) Expenses of the Issuer(subject to inflation) must be Serviced

Puts added pressure on Administrator particularly as more mortgages become prepayed thereby reducing the amount of the mortgage interest

To some extent the risk is diminished by giving the Administrator more freedom to set competitive rates by providing a shortfall contingency fund.

REINSURANCE TO CLOSE AT LLOYD'S AND RELATED ISSUES (GISG CONVENTION, 10/90)

H. Rice and M.G. White

REINSURANCE TO CLOSE AT LLOYD'S

AND RELATED ISSUES.

GIRO 1990

H. RICE
M. G. WHITE

(5473S)

REINSURANCE TO CLOSE AT LLOYD'S
AND RELATED ISSUES.

SECTION 1 - BACKGROUND NOTES (MGW)

1.0 Preamble

These notes have been prepared in response to the increasing interest in Lloyd's expressed at the 1989 GIRO Conference.

For the purposes of the discussion at 1990 GIRO, Section 3 is not essential. It was felt that some notes on data would be of practical interest, but they are not essential to understanding the structure of Lloyd's. The authors are aware that many readers will have little knowledge of Lloyd's, whilst others will be very familar with Lloyd's. In order that everyone can gain something from the session, these notes attempt to give a brief outline of Lloyd's structure, concentrating on those aspects of the structure which will be of most interest to Actuaries. It is hoped that this outline, together with the discussion points in Section 2, will be sufficient to stimulate a debate.

We have tried to concentrate on facts and to avoid expressing too many opinions. If the facts are wrong, this is our own responsibility, and any views which we may have expressed are our own, and not those of our employers. We would welcome correction on any aspects, especially from any Syndicate Auditors present at the conference.

1.1 Names, Syndicates and Years of Account.

1.1.1 Names.

If you have a Lloyd's insurance policy, it is placed at Lloyd's, not with Lloyd's. The cover is provided by individual "Names", who each participate in accordance with their share of the syndicate(s) with whom the policy has been placed. In the old days, the names of all the Names (!) on the risk used to be stamped on the back of the policy document; this is no longer practical, so policies now only show which syndicates are involved and the proportion of the risk which each syndicate is taking.

Names are on a risk "each for his own part and not one for another". If an individual Name fails to meet a loss, recourse is had to Lloyd's Central Fund, not to the other Names on the syndicate. The Central Fund is maintained by a subscription levied on the entire body of Names.

1.1.2 Syndicates.

A syndicate is not a separate legal person like a company. It is merely a convenient way of grouping Names together to accept insurance risks. Each syndicate has its own underwriter who accepts risks and settles claims on its behalf.

1.1.3 Years of Account.

The Names constituting a syndicate change each year. Whilst there is a tendency for Names to stay on a syndicate for a number of years, some will join, some will leave and others will change their planned participation. So knowing that Syndicate 999 has written a risk is not sufficiently precise - one needs to know which year of account has written the risk to define which group of Names is involved and what their shares of the risk are.

Years of Account are not closed until the end of the third year, at which point the liabilities are usually reinsured with the subsequent set of Names on the same syndicate, i.e. with the next year of account.

The following simplified timetable may make the process clearer.

Syndicate 999 - Timetable for 1991 Year of Account.

1)	During 1990	Decide which Names will be on the syndicate for 1991, and what shares they will have.
2)	During 1991	Write risks, receive premiums, pay claims.
3)	As at 31.12.91	Look at accumulated fund, make solvency calculations.
4)	During 1992	Stop writing risks (the 1992 Names will now be writing risks), but still receive premiums and pay claims.
5)(a)	As at 31.12.92	Look at accumulated fund, make solvency calculations.
5)(b)	As at 31.12.92	Write the final risk, a reinsurance of the entire remaining liabilities of the 1990 Year of Account. Look at the premium received, make solvency calculations.
6)	During 1993	Continue to receive premiums and pay claims.
7)	As at 31.12.93	Pay a reinsurance premium to close the account (RITC premium), normally to the 1992 Names. Balance of fund is profit if positive, loss if negative.

Thus during the syndicate's third year of operation, it is effectively carrying the liabilities of all prior years' run-off, to the extent that these have been reinsured through to the syndicate.

1.1.4 Names' Assets.

Names own a share of the assets held within each syndicate they are on, just as they have a share of the liabilities. They also have other funds at Lloyd's (known basically as deposits and personal reserves) and they also have to show a certain level of net means available to meet losses if necessary. These means are calculated after meeting any solvency deficiencies within their syndicates. The detailed capital requirements are not covered in these notes.

1.2 How to Find out about Lloyd's Rules.

Lloyd's Rules are largely contained in Byelaws made under the Lloyd's Act of 1982. These Byelaws are publicly available, and if practitioners want to get the full picture on any aspect they should consult these and discuss any queries with the relevant Corporation department. Practitioners should certainly not rely on these notes, which are intended to give an outline only.

1.3 What RITC is

1.3.1 Defined in a byelaw (number 6 of 1985) to be an agreement where one group of Names reinsures the entire portfolio of a syndicate made up of another group of Names. It does not have to be a contract between the successive Names on one syndicate, nor do the managing agents involved have to be the same. Byelaw No. 17 of 1989, the run-off byelaw, in which actuaries have a role, only comes into play if a syndicate fails to close at the normal time.

1.3.2 RITC is a reinsurance, not a transfer of liability. The original contracts of insurance written at Lloyd's are between the Names who wrote each policy and the policyholders. If, say, the Names on a 1990 year of account failed to meet their obligations, the policyholders who had bought policies from earlier names would have recourse to the 1989 Names, and then the 1988 Names, etc., etc., - IN THEORY.

1.3.3 There are really no rules about how much premium should be paid for RITC - save one. It should be "equitable" between the Names involved. It could be argued that this is obvious as the underwriter(s) and managing agent(s) involved are acting on behalf of both parties. However, the requirement has been set down specifically in a byelaw, the Syndicate Accounting Byelaw, number 11 of 1987.

The byelaw has some explanatory notes which have no statutory force, and these include some guidance as to good practice when determining RITC. The guidance is of a "things to look out for" nature and does not claim to be comprehensive in any way. It is a myth that discounting, whether implicit or explicit, is forbidden, as it is also a myth that there should be no profit element in RITC premiums to pay for any risk involved. The managing agent's task when acting on behalf of two sets of Names could perhaps best be described as being to achieve a willing buyer, willing seller price taking into account all the factors involved.

1.4 What the RITC is not

RITC is not in any way determined by the solvency instructions or by tax considerations. However, being aware of the way in which the contract will come into the tax calculations for both parties and the solvency release or strain involved should theoretically have some effect on the "willing buyer, willing seller" determination, just as a Life Office might look for a higher return on capital if a new product involves particularly high new business strain.

1.5 What the Tax Rules are relating to deductibility of RITC

1.5.1 The following extract is from the 1988 Income and Corporation Taxes Act.

"(a) in computing for the purposes of income tax the profits or gains of the continuing member's business as a member of the reinsured syndicate, the amount of the premium shall be deductible as an expense of his only to the extent that it is shown not to exceed a fair and reasonable assessment of the value of the liabilities in respect of which it is payable; and

(b) in computing for those purposes the profits or gains of his business as a member of the reinsurer syndicate, those profits or gains shall be reduced by an amount equal to any part of a premium which, by virtue of paragraph (a) above, is not deductible as an expense of his as a member of the reinsured syndicate;

and the assessment referred to above shall be taken to be fair and reasonable only if it is arrived at with a view to producing the result that a profit does not accrue to the member to whom the premium is payable but that he does not suffer a loss."

1.5.2 In practice, it is not quite correct to say that the Revenue "impose" a disallowance. A disallowance, if there is one, is the result of negotiations between the managing agent and City 35, the special office of the revenue set up for Lloyd's. One day the question of whether, and to what extent, an RITC is allowable may come up before the Special or General Commissioners, so in negotiation one should be considering what the Commissioners would decide if both sides dug their heels in. The main area of potential disagreement would appear to be where reserving is particularly difficult anyway, viz asbestos, pollution, etc.

1.5.3 If a Name leaves a syndicate, his element of the RITC is always fully allowable. If a disallowance is accepted it is only a deferral of tax relief - each Name is not permitted to deduct part of his RITC on the closing year, but, equally, he does not have to recognise for tax that same disallowed element when received in the following year.

1.6 <u>What the Solvency Rules are</u>

1.6.1 These are set out in the Solvency Instructions which are formally passed by the Council of Lloyd's each year after discussions with the DTI. They specifically state that they are not to be taken to apply for any purpose other than solvency. The liability section says don't discount, but there is no guidance on what reinsurance recoveries are allowable as a deduction from outstanding (and IBNR) claims.

1.6.2 The solvency test technically applies at the Name level, comparing his aggregate liabilities and funds at Lloyd's. Names keep funds at Lloyd's in addition to the funds within the syndicates (which are held via premium trust funds) - these additional funds are in the form of deposits and personal reserves, as mentioned above in 1.1.4.

1.6.3 The rules for the valuation of assets for a Lloyd's Name are fairly similar to those for an insurance company, but they are more restrictive in some ways. There appears to be more emphasis on liquidity.

1.6.4 The rules for the valuation of liabilities are implemented at syndicate level and there is basically a two pronged approach. The instructions say reserve properly for the winding up of all years of account (implying that there should be enough funds if no new business comes in) but in any case that the amount put up should not be less than the greater of tests 1 and 2. Test 1 is the minimum percentage test, with different percentages of net premium for different years of account and audit codes, but with an (outstandings and IBNR) test for the oldest years. Test 2 is basically an outstandings plus IBNR test for all years of account involved.

1.6.5 Syndicate auditors report on the position of each syndicate and the results are centrally processed into per-Name solvency positions. Each Name's other assets at Lloyd's held outside the syndicates are then taken into account. Each Name's position is simply aggregated, solvency deficiencies in one syndicate being offset by solvency surpluses on other syndicates. Only when a Name has been cleared through the solvency test can any remittance of profits be made to the Name.

A "syndicate" for this purpose is each year of account of a syndicate. As the constitutions of syndicates change, it is obviously necessary to keep entirely separate the calculations for the two open years and the closed year.

This is what the solvency instructions mean when they say that the instructions shall be applied separately to each year of account. They do not mean that specific calculations should be made for those years of account which have long since closed and are included in the more recent years of account. The data used for the calculations is of course all kept in terms of the original underwriting years.

SECTION 2 - SOME DISCUSSION POINTS.

2.0 Return on Capital and Risk - are they useful ideas?

2.1 Why doesn't the tax follow the solvency as in, say, Germany?

2.2 Lloyd's has, because of the RITC, a total distribution of profit - doesn't this put Lloyd's at a disadvantage as against the insurance companies who can hold back funds?

2.3 Can't the Name be viewed as an insurance company?

2.4 Lloyd's doesn't discount its reinsurance to close. Doesn't this put it at a disadvantage when competing for long tail business?

2.5 What does equity between Names mean in setting RITC?

2.6 What is the risk margin?

2.7 What if the RITC is set higher than the solvency reserve?

[The solvency instructions say that solvency reserves cannot be less than RITC, so in this case the two numbers are made equal].

2.8 What if the solvency reserve is higher than the RITC?

2.9 This is all very inconvenient. Can't the rules be changed?

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SECTION 3 - NOTES ON DATA AND OTHER PRACTICAL ASPECTS (HR)

3.0 Gathering the Data.

The accounting procedure which gives rise to statistical data consists of the following stages:-

(i) After LPSO (responsible for central settlement of premiums and claims) close books around 20 January, individual syndicates' computer systems (often using external bureau software and facilities) process basic accounting and statistical data.

ii) Accruals of a) premiums receivable net of reinsurance premiums payable and
b) reinsurance recoveries in the pipeline in respect of paid losses

are collated by the syndicate, with allowance possibly being made for bad debts.

(iii) The various Lloyd's claims offices (LUNCO, LUCRO, etc) close as at the same date and liaise with LPSO to avoid discrepancies and provide outstanding claims information. Such information may not be available until mid-February. Data on claims not handled by these offices (e.g. asbestos) must also be collated.

(iv) Each syndicate assesses reinsurance recoveries in respect of outstanding claims, making allowance for reinstatement premiums and burning cost adjustments payable. Allowance for collectability of reinsurance would be made at this stage.

The above process may not be completed until the beginning of March (except for motor and short term life syndicates where LPSO etc are not involved and data may be available in late January). The solvency deadline is variable and is usually towards the end of April, but has been getting earlier.

For reserving purposes, information will also be required on both the nature and mix of the business written, and on reinsurance programmes over the years. Often, such information would be of a qualitative nature for all but the most recent years of account. The reinsurance information should ideally be sufficient to allow in projections for any gaps in the programme, exhaustion of coverage, doubtful security, reinstatement premiums and burning cost adjustments. The underwriter and the claims staff should also be asked to identify for further investigation any special problems which would not be allowed for by normal statistical methods.

3.1 Analysis of the Data.

The syndicate accounting rules require information to be sub-divided into the three major currencies and also into all the relevant Lloyd's audit codes; thus it is likely that triangulations of paid and incurred claims by currency will be

Cont'd/.....

available. Triangulations by audit code should also be available in theory, but some syndicates may not have collated the historical information going back more than a few years; triangulations by the underwriter's class of business codes may also be available.

Following reforms in syndicate accounting, and perhaps also the influence of the Revenue, the resulting data progressions are often on a more rigorous and consistent basis in recent years than was previously the case. Net of reinsurance triangles may show the effects of contracts such as rollovers and tonners which have been banned since the early 80's. Accruals now tend to receive a more "correct" treatment; for example, in the past many syndicates netted reinsurance recoveries due in respect of paid claims against outstanding claims so that paid loss progressions are now smoother than they were. The treatment of reinstatement premium protection policies can play havoc with net claims projections if the payment of reinstatements is classified with net premium statistics and the reinstatement premium policy recovery is classified with net claims statistics. Difficulties may arise in examining triangulations sub-divided by audit code net of reinsurance; market inconsistencies in audit coding can arise when reinsurance recoveries are coded differently to the claims which gave rise to them. It is of course necessary to ensure that the effects of exceptional items are taken out of triangulations, e.g. time and distance policies, unlimited run-off reinsurance policies, latent claims, etc. However, this can be extremely difficult to achieve, especially in relation to latent claims, since LPSO advices do not separately identify them, and also the year of account allocations in the syndicate records may not correspond with the actual LPSO payments.

Whatever the degree of data sub-division and projection method, it is necessary for solvency tests that net premiums, gross outstanding claims, reinsurance recoveries thereon, and net IBNR are sub-divided by the three major currencies and audit code.

As well as working closely with underwriting and claims staff, an actuary will tend to rely on the syndicate auditor in relation to accuracy of the data, and in turn may be called upon to explain to the auditor the extent of actuarial investigations and conclusions (assuming the actuary is acting before the RITC determination is made and not afterwards, as would frequently be the case if he were involved only for tax advice).

3.2 <u>What results are required?</u>

The actuary will frequently be asked to advise on reserves, perhaps for a sub-set of the business, rather than the RITC as such. The RITC is a management decision to which the actuary's advice will be one of the inputs.

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The actuary would usually present his results in terms of ultimate loss ratios, ultimate losses, or IBNR. For the purposes of disclosure in Syndicate Accounts, only one net IBNR number is strictly necessary. However, where possible, best practice is to show gross IBNR and also to show estimated reinsurance recoveries on the IBNR, the net IBNR being the difference between the two.

Given that there may be substantial uncertainties in the projection of syndicates' results for a variety of reasons (latent claims, recently established syndicate without a track record, change of business mix, change from occurrence to claims made coverage, quality of historical data, changes in reinsurance program, etc) then the actuary may give his results in the form of a range within which the results might reasonably be expected to lie. The acceptability of this to the underwriter would depend upon the actuary's term of reference; an auditor, on the other hand, may feel less comfortable with a range than with a point estimate. An extreme position arises when uncertainty is so large that the underwriter considers leaving the year of account open - it is a matter of debate whether the actuary should recommend doing so, or should merely draw attention to the uncertainty and let the underwriter draw his own conclusions.

Finally, although not strictly speaking RITC, the open years (years one and two) still need to be reviewed for the purposes of the Solvency Test. It should be noted that the open year accounts are not drawn up in a manner fully consistent with the closed year treatment; thus, for example, the concepts of prudence and accruals are not required to be applied to the open years of account unless to disregard them would be material or misleading. Hence, not only is there much more uncertainty due to immaturity of claims development and the likelihood of substantial further premium development, but the quality of data may often be very much lower for open years than for closed years, and very variable from year to year. As a consequence, in many cases the best that can be done is to give a rough indication of the expected out-turn and to investigate and comment on any special circumstances which could have a serious impact (e.g. Piper Alpha, natural catastrophes, major changes in business mix or reinsurance protections, major changes in premium levels).

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REINSURANCE AND RETENTIONS - A LONDON MARKET ACTUARIES GROUP PAPER, VOLUMES I AND II (GISG CONVENTION, 10/90)

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REINSURANCE AND RETENTIONS

A London Market Actuaries' Group Paper

VOLUME I

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Anthony Bradshaw
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VOLUME I

Section

VOLUME II

Section 1

INTRODUCTION AND CONCLUSIONS

Introduction

The working party adopted the following terms of reference:

1. To provide a review of some current practices in the field of reinsurance retentions.

2. To investigate and discuss those aspects of general insurance operations which we believe should influence the reinsurance decision process.

3. To present a synopsis of practical methods that may be used in order to translate the identified objectives of reinsurance into an explicit programme and retention policy.

We have defined the retention of a general insurance operation as all business which is not ceded including coinsured layers of excess of loss reinsurance, and any unplaced parts of the operation's reinsurance programme. We stress that we have used the word retention in its literal sense, namely, an amount retained. We consider that a company which has, for example, reinsured itself £90 million excess of £10 million has decided to retain claims excess of £100 million.

The remainder of the paper is divided into three sections. Section 2 covers some aspects of the current reinsurance market, Section 3 a discussion of the factors that influence the reinsurance programme and retention philosophy, and Section 4 summarises the practical methods for estimating aggregate claim distributions and retentions that we have reviewed. Detailed documentation of the application of these methods is contained in the appendices.

We have attempted to address the problems of retentions separately for all types of general insurer, including proprietary and mutual companies and Lloyd's syndicates.

We have assumed throughout that companies reserve accurately for claims since reserving problems and their effects on reinsurance strategy are, properly, the subject of a separate paper. We have not addressed the question of reinsurance security. In practice there is likely to be a trade-off between the cost and the quality of any reinsurance that is to be purchased.

Conclusions

During the last decade computer technology has leapt forward, but, reinsurance practices do not appear to have kept pace. This revolution enables insurance companies to store previously unimagined amounts of data. It also allows the technicians within those companies to experiment with much more ambitious risk management procedures. Therefore, it is likely that many opportunities exist for organisations who exploit the new technology to gain competitive advantage. This is because, historically, reinsurance practice must have applied unnecessary caution in the face of inadequate data and methodology.

A point of particular importance is that a seller of reinsurance will require a return on capital. The purchaser of the reinsurance must be aware of this fact. This is discussed further in Section 3. We have avoided use of the term "probability of ruin" because of the unhelpful connotations of the word ruin. We think that words such as "the probability of a £10 million reduction in earnings" are of more use and importance.

We can try to summarise this paper in one paragraph. First, we believe a retention should be defined as all business that is written but not ceded. Second, an insurer should review its objectives, and from this base develop a retention strategy. The insurer should view reinsurance as a benefit which will incur a cost. The aim must, therefore, be to use reinsurance as efficiently as possible. The retention strategy should be considered from the top down. The requirements of the entire operation must be determined and from this the implications for internal operating units should follow. Third, the estimation of the aggregate retained claims distribution is essential input into the retention process. This is an area where the actuary in particular can add considerable value. In the paper we present a number of methods which can be helpful in calculating these aggregate claim distributions and determining retentions.

Section 2

SOME ASPECTS OF THE CURRENT REINSURANCE MARKET

2.1 Introduction

This section reviews current practices and some of the rules of thumb for determining retentions.

There are a wide variety of reinsurance products. These range from a straightforward Quota Share treaty for a small proprietary insurance company to a financial reinsurance arrangement for a Lloyd's syndicate. We have not attempted here to cover the market practice across the whole field, but rather have concentrated on those aspects which we believe are important to the market as a whole.

Many insurance companies consider their retentions at three levels, "individual account" level, "company" level and "group" level. The overall retention that results is often built from the bottom up.

2.2 Retentions in Practice

It is worth pointing out that despite the increasing array of mathematical techniques available, decisions regarding retention levels are still based on rules of thumb, and a desire to conform to market norms. This is due, in part, to the impractical data requirements of some theoretical methods, and their often unrealistic assumptions (for example, independence of risks).

Companies may, for commercial reasons, also purchase more (or less) reinsurance than they need, or that various theories might imply. The practical importance of these commercial factors needs to be borne in mind when considering the validity of any methods, or theories, for setting retention levels.

In many instances, the choice of retention level is made by the underwriter of the account under consideration. He will use his skill and judgement, based on his knowledge of the account, to decide the best retention level. The aim, in deciding on this level is more likely to be to balance the relationship between profits and stability, rather than to reduce the risk that capital is exhausted. The probability of ruin is not a concept which underwriters are likely to consider.

A survey of U.S. insurance companies conducted by the Munich Re in 1976, showed that the main factors which were then considered when setting retention levels were, (in order of priority) level of capital, cost of reinsurance and smoothing of earnings fluctuations.

We are not aware of any more up to date surveys, but some previous studies (References 6 and 10) had highlighted the commonly held belief that retention levels should be positively correlated with the size of the company (as measured by premium income or capital/reserves). It is however thought that some composite insurers hold much lower retention levels than their size would indicate, perhaps due to the relatively low cost of reinsurance during a soft market, the risk aversion of the company, or other commercial reasons such as reciprocity. Also, a company which operates a profit-centre approach for each of its categories of business, without any central rationalisation, will probably have lower retentions than one which looks at its retentions on a more global basis.

Retentions considerations should focus on the amount of cover purchased as well as the size of the deductible. This is particularly true for event covers such as catastrophe excess of loss. Several insurance and reinsurance companies have developed their own loss accumulation systems which help them to decide how much catastrophe reinsurance to purchase. These systems can also prove useful in deciding the level of the catastrophe deductibles.

In practice, deciding on the deductible is only part of the process. The structure of the reinsurance programme will affect how much protection is provided. Factors such as the number of reinstatements purchased, inclusion of any drop-down facilities in the contract, vertical versus horizontal cover, and the availability of back-up covers will need to be considered. Underwriters look for continuity of cover: changes are gradual rather than sudden and will generally be in one direction (that is, upwards). There is often reluctance to increase the retention voluntarily.

Other important factors include the risk willingness of the company's management and the capacity (and, therefore, price) of the reinsurance market. Regardless of what retention may be theoretically correct, the market conditions may be such that cover is simply not available. An example of this was the upheaval of the retrocessional market which occurred following the windstorms in Europe in early 1990.

The extent to which companies/syndicates use brokers for advice about retention levels is unclear, but their use to provide alternative quotations for different reinsurance programmes is one way in which a company can obtain help to decide on the best retention. It should be noted, however, that a broker has traditionally earned a living from the placing of reinsurance rather than advising clients to retain risk.

2.3 Rules of Thumb for Setting Retention Levels.

2.3.1 Risk Theory Approach

This approach, which is based on a Normal approximation, assumes that the optimum retention is defined in terms of a per risk excess. Reduction of the probability of ruin to a certain minimum is the target. The theory is developed in Reference 1 and leads to formulae relating the retention, premium loading and free reserves.

These formulae, in turn, lead to a rule of thumb described below, where the maximum retention should not exceed a certain percentage of the free reserves.

Other risk theory approaches involve modelling the aggregate claims distribution. The effect of different forms of reinsurance and different retentions is assessed by analysing the changes in the net retained aggregate claims distribution. The aggregate claims distribution can be modelled by combining the claims severity and claims frequency distributions using a range of possible techniques.

2.3.2 Rules Based on Maximum Percentages

Perhaps the most commonly quoted rules of thumb are those which link the retention level, again a per risk excess, with items such as free reserves and premium income:-

TABLE 1 - RETENTION RULES OF THUMB

As a percentage of:-	Retention
Capital and free reserves..................	1 - 5%
Retained premium income (by class)..........	1 - 10%
Liquid assets..............................	400 - 600%

These rules assume that the aim of the reinsurance programme is to smooth out fluctuations in the net retained account. This is achieved by setting the retention so that a single large claim cannot impact the company by more than, say 5% of its free capital or 10% of premium. By measuring the retention against its liquid assets a company can try to ensure that it has enough cash available to meet a single claim.

Claim in this context means either a single large claim affecting a single risk or an accumulation of relatively small claims arising out of a single event.

These rules of thumb can be expressed differently. The company can determine what percentage of the profits of a class of business they are prepared to lose. This amount combined with estimates of the maximum operating ratio and written premium of the Quota Share treaty will imply a retention.

For excess of loss reinsurance, the retention can be based at the level at which claims become very infrequent or alternatively the level at which the average claim up to that point starts to show significant variation year on year. The basis for this method is that if a claim of a certain severity occurs frequently then claims of that severity are not giving rise to significant variation in results.

For property portfolios, the common practice when designing a Surplus treaty is to compile a table of limits which shows the company's retention for different risk categories.

This could be constructed by firstly deciding on a minimum retention. The retentions for each risk category are then calculated by scaling this minimum in relation to the relative premium loadings for each risk category (Reference 4). In practice, of course, the individual underwriter's experience and judgement will play a major part in determining the retention levels in the table of limits.

Companies do, in practice, vary their retention levels both by risk category within a class, and between classes of business. It is common practice for underwriters to fix their Surplus retention levels so that they are, broadly, inversely proportional to the original premium rates which they charge (In other words, they keep more of the less hazardous risks). It is preferable that retention levels should be based on some assessment of the quality of the risk (for example, as measured by the construction type for Fire insurance) rather than in direct proportion to the actual premium rates.

Section 3

RETURN TO FIRST PRINCIPLES

3.1 Introduction

This section sets out the general considerations relevant to determining reinsurance retentions. Our intention is to return to first principles and consider why companies require reinsurance. We believe that it is from this point that a reinsurance strategy should be built.

The first key point is that the aims of the general insurer in its entirity must be the starting point for a retention policy. As we have seen, in many instances individual units within a general insurer develop their own retention strategy. The retention of the total is the sum of the pieces and may, or may not, be appropriate. In other words retention strategy develop from the bottom up; it should be designed from the top down.

We now consider the major influences in determining the retention of general insurers at the top level. Many of the ideas presented are equally relevant when determining retention strategy for individual business units based upon a global strategy.

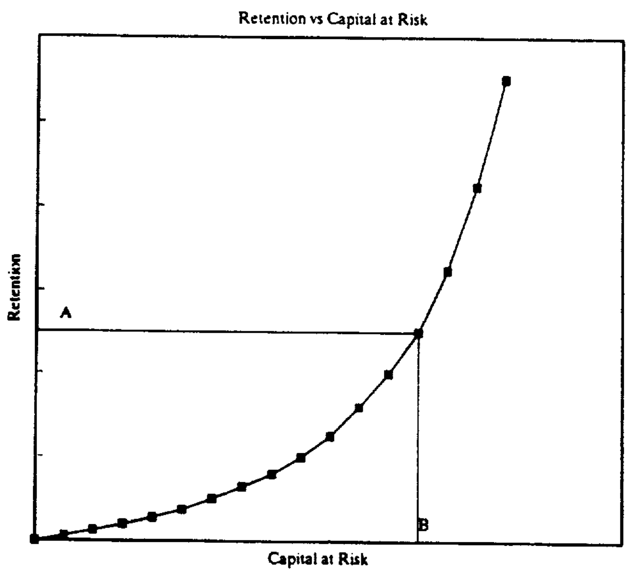
The process of setting a retention level is related to the control of exposure. The control of exposure is the last part of a three stage process.

1. Identify Exposure
2. Quantify Exposure
3. Control Exposure

For an employers' liability insurer, the process of exposure identification should focus both on large claims, and aggregation arising either from industrial disease, or an explosion. A property insurer may have exposure to aggregation from one natural catastrophe in addition to aggregation from adjacent sites and exposure to total loss on one risk. These identified exposures represent potential claims for which insurance may be required.

The second step in the process is the quantification of the severity of potential loss from the identified exposures together with their associated probabilities. Some techniques for achieving this are described in Section 4.

We have adopted a standard presentation of the results of these techniques, which is to show the effect on free reserves of having different retentions. An example of these graphs is shown below:



The graph is to be read as follows: if the retention is set at Level A there is a likelihood of 5% of losing an amount equal to B of free reserves. The actuary can use these graphs to help management quantify a subjective assessment of risk.

The objectives of a company play an important part in determining its retention. Some of these are discussed below for each type of insurer. We then review two general considerations which should effect retentions, namely, the underwriting cycle and the cost of reinsurance.

3.2 Exposure Control

We feel it is important to stress that an insurer's retention should be as much a reflection of its perceived risk aversion as of the underlying distribution of its claims or of conditions in the reinsurance market. Risk aversion depends on the financial condition of the company, and its corporate culture, and is reflected in the reinsurance protection it purchases.

In determining retentions, we need to consider measures by which to quantify unacceptable claim deviation. Possible measures, at a "group level", are the effect on earnings, the effect on shareholders funds, on share price or on Names. We have only presented results in terms of the effect on shareholders' funds.

The insurer must consider its objectives. These objectives may be different for the following three groups:

1. Proprietary insurance companies
2. Mutual insurance companies
3. Lloyd's syndicates.

Proprietary Insurance Companies

For a proprietary company the objective must broadly be to produce a long-term return on capital employed commensurate with the risks involved, and, in the short term, to distribute part of this return as a smoothly increasing dividend.

For a publicly quoted proprietary company, there is also a need to maintain the market share price. This price, to a great extent, is influenced by the return on capital and dividends. Other influences include analysts' comments and market perception of the company.

Some companies form part of conglomerates which have higher quality earnings streams from other activities which may allow the general insurance operation greater variability in results without jeopardising the overall corporate objectives.

Some proprietary companies are set up as captives to write the insurance risks of a larger parent company. In such a case, setting profit objectives is purely an internal or tax accounting process. The objectives of the captive will be aimed at controlling the variability of the results, thus protecting solvency, and developing the captive.

Companies can attempt to control the emergence of profit in the following ways:-

1. Via alterations in reserve surplus.
2. By realising investment gains.
3. Using reinsurance.

At the start of any trading period, the status of the company's reserve surplus and unrealised investment gains must be taken into account. The first two methods of smoothing are cost effective for the company, however, it is only the third that has an elastic supply. The company may determine its retention by examining:-

1. The expected profit in the ensuing period.
2. The variability associated with that expected profit.
3. The desired variability in profit in the ensuing period.
4. The availability of reserve surplus and unrealised investment gains to smooth the difference between the actual and desired variability.

Mutual Insurance Companies

It is likely that the main objective of a mutual is to build up the solvency of the company in order to enable it to write more risk. The control of variability will be pitched at a level that protects solvency rather than annual earnings.

As a result, the mutual is more likely to focus on the maximum amount it wishes to lose in one year. For a large well established mutual the Estimated Maximum Loss from one event may be very small in comparison to the financial resources. In such a case reinsurance is probably not required.

For a small mutual, such as the one of the professional indemnity vehicles that have become commonplace during the last ten years, incurring gross claims in excess of called capital may be a very real possibility. To reinsure very heavily defeats the object of the mutual. The managers might focus on the maximum capital the members wish to have at risk in any year (which may well be much greater than the called capital) at given levels of probability.

The mutual may determine its retention by considering:-

1. The variability associated with the claims costs.
2. The desired capital at risk during the ensuing period.

The retention should be fixed to ensure that items 1. and 2. are consistent. The reserve surplus and unrealised capital gains do not feature directly because revenue account profit is not of overwhelming importance. However, in determining the desired capital at risk, the members will consider the capital already available in the mutual which should include the above items. A small mutual provides an example of where a desired retention profile might be achieved by alteration of the gross portfolio rather than by via reinsurance.

Lloyd's Syndicates

Lloyd's syndicates are different from insurance companies in two ways. First, the shareholders on each underwriting year are separately identified. Second, investment income is only earned on insurance funds which are invested in similar assets for every syndicate until the underwriting year is closed. The investments are generally risk free in nature. Thus, the underwriting result becomes the major source of variation in results between different syndicates and different years of account on the same syndicate. This differs from proprietary companies in two respects, first investment income is of secondary importance and second separate cohorts are considered rather than the change in the overall financial state of the company during the period.

The retention philosophy must focus on controlling the variability of the underwriting result for the individual underwriting year during the three year period prior to closure. It is fair to assume that all underwriters work on the basis that they will close the year in the normal fashion after thirty-six months and set their retention accordingly.

If we suppose that all names require the same variability then a further complication arises from Names participating in varying numbers of "independent" syndicates. Even if all syndicates have identically distributed underwriting results, different Names would experience different variability due to different participations.

Reserve surplus and unrealised capital gains should not have a role in the control of variability at Lloyd's. The syndicate may determine its retention by examining:-

1. The expected result of the underwriting year.
2. The variability associated with that expected result.
3. The desired variability in the underwriting result.

Since Names are generally risk averse, we believe that the retention is primarily aimed at obtaining the desired level of variability. The Lloyd's syndicate can be faced with a unique problem since attaining the desired level of variability could imply purchasing so much reinsurance that the expected profits will be unacceptably low. The underwriter is faced with a dilemma, either reduce the profit or increase the variability.

Variability in Claims Costs

Variability in claims costs are dependent on the amount and nature of the business written. For a major composite insurance group the gross book of business may very nearly conform to that which is desired. For a small company writing LMX business, the gross distribution is likely to be extremely unsuitable and require considerable alteration.

Variability can be reduced by reciprocal reinsurance with another insurer. We define a reciprocal reinsurance as one where the quantum of risk ceded and accepted are equal. The point of this contract is to reduce the variability in the book of business via diversification. Many large insurance operations will already have optimised their diversification via world wide operations and will not add value via reciprocity.

After effecting the reciprocal reinsurance the insurer is left with a redefined book of business. If the characteristics of this business are still incompatible with the objectives then reinsurance can be utilised.

If reinsured and reinsurer both accept that "reinsurance costs money", then long term good relationships with reinsurers can be very valuable. Once this relationship exists and the purpose of reinsurance is established, there should be no barriers to the type of reinsurance cover available provided both parties are satisfied. This, in turn, might allow a simplification of current reinsurance programmes and thus savings on the administration side.

3.3 The Underwriting Cycle

We have not yet discussed the affects of the insurance cycle. An analogy can be drawn between the general insurer and a geared investment trust. Premiums represent borrowed funds. In this analogy a softening market leads to an increase in the cost of borrowing. Usually, there will be no correlated or predictable change in the investment return, and hence, the unit profitability is squeezed. In this situation most types of general insurer will become more variation averse. The expected profit is low, and hence, the acceptable downside is reduced. A priori, the insurer will wish to change the retention to reduce variability.

Under these circumstances the company may cede business at unprofitable rates (for the reinsurer) and in this way improve the short term profitability without loss of business. The cedent should acknowledge that a pay back to the reinsurer will be required in the future. However, this will occur at times of greater unit profitability and so the objective will have been achieved. This is the second way in which the insurance cycle may affect the retention.

This concept is particularly true of the London Market where the rates at the bottom of the cycle can be extremely soft, but each player in the market is supported by equally cheap reinsurance. However, historically there have been reinsurers of London Market companies who have been "fair game" and not received a pay back. The London Market operation of the Insurance Corporation of Ireland is one such company.

The London Market may be considered from a different perspective - as one insurance entity, with each company or syndicate a "department", often the last retrocessionaire for much of the world's market. The reinsurance rates that individual "departments" charge each other are unimportant to the entity as a whole since these merely constitute internal accounting. If we view the market from this perspective, the entity suffers from the cycle when the rates it receives for business ceded into the market are too low. It overcomes the cycle by reducing the profit of each department and by "cannibalising" one or two departments. In other words, the market cedes much of it's loss to these "departments" who never recover. The LMX spiral partly arises out of each "department's" desire not to be one of the "cannibalised".

3.4 The Cost of Reinsurance

Any purchaser of reinsurance needs to bear in mind that the reinsurer is a commercial enterprise and requires a return on capital. The cedent should expect reinsurance premiums to exceed recoveries in the long term and, as such, this represents a cost. The purchase of reinsurance, therefore, reduces profits in the long term. In return the reinsurance provides some stability of claims costs to the cedent.

A principle that we consider should underlie any discussion of an appropriate retention for a company is that the company should avoid purchasing any unnecessary reinsurance.

Section 4

MATHEMATICAL MODELS

4.1 Introduction

At whatever level within a general insurer while investigating retention philosophy, understanding the variability associated with the relevant aggregate claim distribution is essential. In this section we demonstrate some methods that can be used when estimating aggregate claim distributions and investigating retentions. Where possible, we have demonstrated the use of these methods on three case studies. The details of the calculations are given in Appendices 1 to 4.

The three case studies consist of aviation, liability and property risks. Exhibit 1 contains the underlying severity distributions used to derive the aggregate claims distributions on which our analysis is based.

We express the effect of different retention levels as reductions in free reserves together with associated probabilities. Equally, results could be expressed in terms of premium income, earnings or other measures. An increase in retention should not necessarily be seen as increasing the probability that a company will face ruination. It can more usefully be seen as increasing the probability of a specified reduction in free assets or earnings. This increased variability is compensated for by an increase in the expected profitability.

We have used four methods to quantify these effects. The methods used are not intended to be exhaustive, nor, to be necessarily the best methods available. They are methods which have either been used by the members of the working party or which are believed to be commonly used.

We would like to stress that the results of these methods are only as good as the assumptions underlying them which may, in some instances, be very limited. In particular, the assumptions concerning the tail of the probability distribution can be critical when examining retentions.

4.2 Straub's Method of Calculating Retention Levels

This method is based on the theory developed in Erwin Straub's book "Non-life Insurance Mathematics" (Reference 18). Straub develops a mathematical representation of the following intuitively reasonable relationship:-

$$\text{RETENTION} = \frac{\text{CAPITAL} \times \text{RISK WILLINGNESS} \times \text{PROFIT MARGIN}}{\text{UNBALANCEDNESS}}$$

If four of the elements of the equation are known then the fifth is implied. The formula can be used to investigate the relations between capital and retention. A different formula is developed for each of the common types of reinsurance. The method takes the classical risk theory approach and considers an infinite future time period. This is different from the approaches presented in the next three sections which consider a finite future period.

The capital item refers to the free reserves backing the class of business under consideration. Risk willingness is expressed as a function of the tolerated ruin probability (or probability in the examples of Appendix 1). The smaller the tolerated ruin probability, the lower the risk willingness of the company. Unbalancedness is dependent on the type of business written and is determined essentially by the distribution of total aggregate claims.

The relationship follows certain intuitive rules. For example, if we increase the unbalancedness of the portfolio, then ceteris paribus, we would expect the retention to decrease. Alternatively, as the risk willingness of the insurer increases then so should the retention.

In its most general form, Straub's formula relies on very few assumptions about the risk process which is being considered. However, for the purposes of the examples used to demonstrate the method in this paper, we have assumed that:-

1. There are equal loadings used by the insurer and reinsurer. (This makes the mathematics easier!).
2. The claim amount distributions can be approximated by discrete distributions.
3. The claim count distribution is Poisson.
4. Either Quota Share or Risk Excess reinsurance is used.

After fixing the various components of the formula, the method calculates either the Quota Share or the Risk Excess retention. By varying key components such as risk willingness and capital, graphs may be drawn to summarise their inter-relationship.

This method has the advantage that it allows explicitly for all of the important items when setting retentions. The items are linked together in a neat formula.

In addition to calculating a retention level, it is also possible to use the method to calculate a measure of the need for reinsurance. This is clearly an important consideration before deciding what retention to hold. However, given that a particular company needs reinsurance, the method provides little help in deciding what form of reinsurance is the most efficient.

4.3 Heckman and Meyers' Method for the Calculation of Aggregate Loss Distributions (Appendix 2)

The basis of this method is published in a paper entitled "The Calculation of Aggregate Loss Distributions From Claim Severity and Claim Count Distributions" published in 1983 (Reference 11). The method works by convoluting the severity distributions of individual claims. This is achieved by the use of characteristic functions and then inverting the resulting integral by means of numerical integration techniques as described in the paper.

This gives a powerful and practical tool for calculating probability points on the aggregate claim distribution together with excess pure premiums (that is, stop loss risk premiums). Furthermore, the method allows aggregate distributions to be calculated for the combination of a number of lines of business.

Once the method has been set up on a computer, it is quick to use. For example, it is easy to amend the severity distribution to allow for changes in retentions and then recalculate the aggregate claim distributions. By reading off the sizes of aggregate claims at various retentions and probability levels, the effect of various retention strategies can be assessed.

The assumptions underlying the method are:-

Claim Count Distribution

The method can be constructed on a Poisson, Binomial or Negative Binomial claim count distribution. The distribution is, thus, described by two parameters, namely, the expected number of claims and the contagion or contamination parameter. If this second parameter is zero then the Poisson distribution is assumed. If it is positive then we have the Negative Binomial or Polya distribution and if it is negative, then we have the Binomial distribution.

Use of positive contagion is helpful in practice as it makes some allowance for non independence of claims, that is, a higher than expected number of claims in one period can increase the expected number of claims in a future period.

Claim Severity Distribution

The method requires a cumulative probability distribution that is piecewise linear. This results in a great deal of flexibility because any distribution can be represented to any desired degree of accuracy by increasing the number of points in the approximation.

In contrast to the recursive method (Section 4.5), this approach does not require equally spaced intervals. The approach facilitates the use of empirical distributions as exhibited by the underlying data without the need to fit a standard distribution.

The analysis of claim severity is relatively straightforward. In practice, though, it is often helpful to pay special attention to the upper tail of the distribution. In most cases, use of a distribution fitted only to the largest claims can be of value, particularly when coupled with an examination of the underlying claims process and exposures.

Parameter Uncertainty

In practical situations, parameter uncertainty can far outweigh the variation that can occur from randomness within known frequency and severity distributions. The Heckman and Meyers' approach can reflect both sources of variability by introducing a mixing parameter which has an Inverse Gamma distribution and is applied to rescale the claim severity distributions, increasing the level of variability. The effect of this parameter may be removed from the method by setting it to zero.

4.4 A Simulation Method for Retention Determination (Appendix 3)

The essence of the method is to simulate both gross and net aggregate claims distributions in order to assess the effectiveness of different reinsurance programmes. Here a retention is defined as in Section 3 to be everything that is not ceded.

Simulation is very flexible and facilitates the examination of the distribution of claim costs on a per claim, per event or per year basis. Even if the probability distribution of the severity of an individual catastrophe claim is a standard one that can be treated analytically, the distribution of the aggregate annual catastrophe costs to an insurer can be very complex.

Some of the alternative methods used for calculating aggregate claims distributions rely on assumptions such as the independence of individual claims. There are many instances in general insurance where such an assumption is invalid. A strength of the simulation approach is that it does not require this assumption. All this work is based around the use of simple spreadsheet models on a personal computer.

Any random variable with a known density function can be simulated provided that random samples from the uniform distribution over the unit interval (0,1) are available. (U(0,1) random variables) The practitioner can therefore define any empirical distribution for gross claims. Similarly, the effects of most reinsurance programs on the gross claims can be defined parametrically.

The example given in Appendix 3 considers all aspects of a model for UK property catastrophes. The limitations of the analysis are as important as the results themselves. In particular, the use of the standard deviation as a variability measure needs investigation.

The simulation in Appendix 3 depends on claim distribution assumptions. Claims are, of course, the result of random events such as hurricanes. Models can be built for catastrophes where the underlying natural phenomena themselves are simulated, and a separate stage is required to calculate the impact of the event on the insurer. This allows the modeller to use larger and more credible data, such as meteorological records, and thus improve the reliability of the simulations.

A particularly fine example of this, in our opinion, is a methodology for estimating US windstorms claims described in "A Formal Approach to Catastrophe Risk Assessment and Management" by Karen M. Clark (Reference 7) contained in the 1986 Casualty Actuarial Society discussion paper programme.

In this model, windpaths are represented by frequency and severity probability distributions which vary by location. The derivation of these distributions depends on an understanding of the dynamics of hurricanes and the use of historical meteorological data.

Insured properties are classified by location, age and structure. The connection between the windstorm and insured risks made by applying damage and vulnerability factors to the insured values. These factors are based on engineering studies.

Monte Carlo simulation is then used to produce two thousand years of experience. Each simulation results in a hurricane severity at each location (which is zero if the hurricane does not reach the location). The combination of simulated severities and insured values produces simulated claims at each location. Aggregated claims for each simulation gives a distribution of catastrophe claims.

The methodology has certain attractive features. It combines a practical understanding of meteorology, of engineering and of the distribution of insured risks and it has particular value where historical claim experience is limited or where external factors (for example, climatic changes) are considered important. The method does, however, require the insurer to maintain an extensive and detailed exposure database.

4.5 The Recursive Method for the Calculation of Aggregate Claim Distributions (Appendix 4)

The objective of the method is to estimate the aggregate claims generated by an insurance portfolio. The approach is to assume the aggregate claims can be represented as the sum of a number of individual claims where the number of claims is, itself, a random variable. The aggregate claim distribution can be calculated directly from a straightforward recursive formula.

To make the model more tractable, two assumptions are made:-

1. The individual claim severities are identically distributed random variables.
2. The number of claims and the individual severities are independent random variables.

If the mass function assumed for the claim frequency is of the type where successive values are related by a recursive relationship (Reference 1 eq^{n} 2.9.13) then the formula is easily manipulated. The model is referred to as the Collective Risk Model in risk theory. In the special case where number of claims has a Poisson distribution, claims are said to have a Compound Poisson distribution.

The mass function of the aggregate claims can be found by direct numerical calculation if the severity distribution of individual claims is a discrete equi-distant distribution according to which only the values

$$Z_i = iZ_1 \qquad i = 1, 2, 3 \ldots$$

can occur. In the simplest case, this reduces to a subset of the natural numbers.

The required aggregate claims mass function can then be calculated using the recursive formula (Reference 1). The effects of different per risk retentions are reflected in the distribution selected for the individual claim severities. Repetition of the calculations with different retentions facilities a comparison of the effects of these retentions on the aggregate claims distribution.

Section 5

GLOSSARY OF TERMS

Aggregate claim distribution - The distribution function of total claims during the specified period for example, a year.

Annual aggregate stop loss - A reinsurance cover capping the aggregate claims incurred in a period.

Coefficient of variation - The ratio of the standard deviation of a random variable to its mean.

Convolution - The combination of the density functions of two or more random variables to yield the density function of the combined variable.

Deductible - The amount of risk retained below the attachment point of a reinsurance cover.

Density function - The function representing the probability mass of a continuous random variable.

Distribution function - The function representing the cumulative probability mass of a random variable.

Drop-down cover/Top and drop - Excess of loss reinsurance cover with flexible attachment points and limits.

Financial reinsurance - Reinsurance where the quantum of recovery is known and only the timing of payment is uncertain.

LMX - London Market Excess, that is, reinsurance of a London Market reinsurer.

Mass function - The function representing the probability mass of a discrete random variable.

Per risk excess - Excess of loss reinsurance for individual insured risks.

Polya - An alternative name for the Negative Binomial distribution.

Probability of ruin - The probability that the free reserves of an insurer are exhausted.

Profit centre - An individual unit within an organisation with separate financial objectives.

Reinstatement - The process of replacing an excess of loss reinsurance once a claim has been made.

Unbalancedness - The degree of fluctuation inherent in the profitability of a portfolio of business.

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REINSURANCE AND RETENTIONS

A London Market Actuaries' Group Paper

VOLUME II

CONTENTS

Section 7

Appendix 1

EXAMPLE APPLICATIONS OF STRAUB'S METHOD

A1.1 Introduction

Straub's method has been applied to the aviation, liability and property examples mentioned in the Introduction to Section 4. For simplicity we shall only consider the use of either Quota Share or Risk Excess reinsurance. These may not be the most appropriate forms of reinsurance for the class of business in the examples, but they serve to illustrate the use of Straub's method. In each example a discrete distribution was used for claim amounts (Exhibit 1) and a Poisson distribution for claim numbers.

The results are shown in Exhibit 2 pages 1-12. The graphs demonstrate the effect on the retention level of varying the capital at risk and the desired probability of exhausting that capital over an infinite period. The tables show the numeric results of using Straub's method. The graphs are not directly comparable with those of the other methods, which consider finite future time periods.

A summary of the results for a 60% solvency margin (that is, capital at risk of 60% of gross premiums) and probabilities at a one in one thousand level are shown in Table 2 below:-

Table 2 - Results of Straub's Method (Amounts in £000s)

	Aggregate Claims Coefficient of Variation	Quota Share Retention	Risk Excess Retention	Capital* at Risk for no R/I
Aviation	0.79	3%	405	1500%
Property	0.23	46%	75	130%
Liability	0.17	87%	1,875	68%

* Expressed as a percentage of premium.

The following general observations can be made from the results:-

1. The relationship between capital at risk and retention level is linear for a Quota Share, whereas it depends on the claim amount distribution for Risk Excess reinsurance. This is a direct result of the structure of Straub's formula.

2. The Quota Share graphs can be used to determine the point at which no reinsurance is required - that is, the level of capital at the point where the Quota Share retention is 100%. For a probability of one in one thousand this point is shown in the final column of Table 2.

3. For a given probability, the retention increases as the available capital at risk increases.

4. For a given capital at risk, the retention increases for companies which are less risk averse (that is, as the probability increases).

5. The rate of change of retention with respect to capital at risk is lower for a lower probability. In other words, the more risk averse a company is, the less will be the effect on its retention policy of an increase in available capital at risk (due to capital injections etc.)

6. The coefficient of variation (CV) of the aggregate claim amount distribution summarises the variability of this distribution. The above table indicates that the higher the CV, the greater the need for reinsurance and, hence, the lower the retention.

Some brief comments on each example based upon the stated capital and probability assumptions, are as follows:-

A1.2 <u>Aviation Example</u> (Exhibit 2 Pages 1 to 4)

1. There is a very high coefficient of variation, leading to very low retentions.

2. Annual expected gross claims are about £74 million.

3. Across a range of practical levels of capital at risk, the retention level changes very little and is very low.

4. These results indicate the highly volatile nature of this business. In practice, the use of coinsurance or pooled arrangements helps to spread the risk across the market.

A1.3 Liability Example (Exhibit 2 Pages 5 to 8)

1. In this example, annual expected claims are about £10m, with approximately 260 claims per annum.

2. Risk Excess reinsurance is likely to be used here (in conjunction with other forms of reinsurance).

3. The method suggests a retention of about £75,000 which seems reasonable.

4. Such a retention would lead to the reinsurer being involved in 10% of claims.

5. As the capital at risk approaches 100% of premium then there is a rapid increase in the retention and a reduced need for reinsurance.

A1.4 Property Example (Exhibit 2 Pages 9 to 12)

1. This example has the lowest coefficient of variation of the three examples and hence we might expect the retention to be higher. The graphs demonstrate that reinsurance is not needed when the capital at risk is greater than the 70% of premium.

2. The retention is quite high at 87% for a Quota Share and £1.9 million for a Risk Excess (above which there might only be three out of 13,000 claims!).

3. 87% could be considered as an average retention for a Surplus treaty, which is the commonly used form of reinsurance for this class. It is doubtful whether, in practice, an insurer would have a Surplus treaty which ceded such a small percentage of the business.

4. In practice, Catastrophe Excess of Loss would also be used to cover against events such as windstorm.

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Appendix 2

EXAMPLE APPLICATIONS OF HECKMAN AND MEYERS' METHOD

A2.1 Introduction

This appendix demonstrates the use of the approach as published by Heckman and Meyers (Reference 11). The Heckman and Meyers (H & M) method was applied to the same three data sets, namely, aviation, liability and property.

A2.2 Outline of Approach

The core of the approach is to use the H & M method to produce an aggregate claim distribution for given input frequency and severity distributions. In order to use this to provide information on varying retention levels, the algorithm must be used a number of times allowing for varying retention and reinsurance costs. The objective is to calculate the capital at risk for a given retention level and probability level. Capital at risk for a given probability level may be defined as follows:-

Capital at Risk	=	Net aggregate claims at given probability level, less net premium received.

Where:

Net Premium	=	Gross premium received less expenses less cost of reinsurance

The cost of reinsurance will depend on the retention level and market conditions. In this section we (unrealistically) assumed the cost of reinsurance is related to the risk premium with a constant percentage loading, regardless of the retention level. We have also assumed that the expenses are split in proportion to the risk premium independently of the retention level. This may also be unrealistic. In practice, one would aim to use realistic figures based on the current state of the reinsurance market. For all the examples in this paper we have:-

Table 3 - Cost of Reinsurance

		Percentage
Gross Premium	:	100
Risk Premium	:	70
Expenses	:	20
Profit Loading	:	10

For readers more familiar with the λ of Risk Theory, the above represents a λ equal to 1/7, (that is, approximately 14%).

For a particular retention, the first step is to calculate the reinsurance risk premium. The cost of reinsurance is then calculated as that risk premium loaded for profit and expenses. For example, say the net risk premium is 50% of the gross premium, we then have:-

Table 4 - Calculation of Net Risk Premium

	Percentage
Gross Premium	100
Less total expenses	20
Less reinsurance (net of expenses)	57
Net Premium	23

The next step is to adjust the gross claim severity distribution for the effect of the reinsurance retention. The frequency distribution does not require adjustment. The H & M algorithm is then run to produce a table of net aggregate claims at various probability levels. The amount of aggregate claims at the desired probability level is then read off and the net premium subtracted to give the capital at risk for that retention and probability.

The exercise is repeated a number of times to build up a picture of the capital at risk for varying retention levels. These may be represented graphically and interpreted to select an appropriate retention level. Exhibit 3 Page 1 shows an example graph.

For a given retention level, the capital at risk of the various probability levels may be determined from the graph. Alternately, for a given capital at risk the retention consistent with various probability levels may be read from the graph.

For a company as a whole, there are often many lines of business with differing retention levels. The H & M method is specified in their paper to handle multiple lines and so the corresponding capital at risk for an entire company can be easily derived for a given set of retention levels.

This general approach can also be used for other methods of calculating aggregate claims, for example analytical or recursive methods.

A2.3 Assumptions Made in Calculating Aggregate Claims

Claim count distribution : Poisson

This implicitly assumes that the variance of the number of claims is equal to the expected number of claims. A larger variance could have been assumed by use of the negative binomial distribution (that is by using a positive contagion parameter in the H & M algorithm)

Similarly, a smaller variance could have been assumed by use of the binomial distribution (negative contagion parameter).

Claim Severity distribution: Piecewise linear.

The distribution used is based on past claims experience. Past claims were sorted into ascending order and assumed to be equally spaced on the probability scale. The cumulative probability was then calculated and various claim sizes selected to represent the severity distribution. In the case of the liability claims, a log-normal distribution was fitted to the large claims and the actual largest two or three claims were replaced by their fitted values.

Parameter Uncertainty: None

The variation was assumed to come only from that implicit in the claim count and severity distributions. Additional variation could have been incorporated, for example to allow for uncertain future inflation by using a non-zero mixing parameter in the H & M algorithm.

A2.4 Aviation Example (Exhibit 3 Pages 2 to 7)

The frequency and severity distributions used are summarised in the table below. All figures in the example are in thousands. The underlying claim severity distribution is shown in Exhibit 1 Page 1.

Table 5 - Aviation Example Frequency and Severity Distributions

Severity Mean	=	9175
Claim Frequency Distribution	=	Poisson
Mean Claims Per Year	=	8.000

Multiplying the means of the severity and claim count distributions gives expected aggregate claims of £73,398,000. Loading for expenses and profit produces a gross risk premium of £104,854,000. The gross data is initially used unadjusted as input into the H & M algorithm. The output produced from the calculation is contained in Exhibit 3 Page 2.

The column headed 'Entry Ratio' in the table refers to the ratio of claims on the aggregate distribution to the aggregate mean. The column headed 'Excess Pure Premium' refers to the stop loss risk premium. Some diagnostics from the numerical integration process are also included is the output.

From the columns of aggregate claim amounts and probabilities, the aggregate claims at 90%, 99% and 99.9% may be determined by interpolation.

Having calculated aggregate claims from the gross claims, the next step is to adjust the claim severity distribution for a retention level. The mean of the truncated distribution is easily calculated as the distribution remains piecewise linear; this is multiplied by the expected number of claims to obtain the net risk premium. The reinsurance risk premium is calculated as the difference between the gross and net risk premiums. This leads to figures for the capital at risk for the retention level under consideration. Repeating the process for a number of retention levels builds up the complete picture. Exhibit 3 Page 3 below summarises the results for this class of business. These results are plotted in the graphs in Exhibit 3 Page 4 to 7.

Checks for reasonableness

Beard, Pentikäinen and Pesonen (Reference 3) give a formula for a distribution free upper limit for the capital at risk (based on the normal power approximation):

$$U \leq y\sqrt{PM} - \lambda P + \tfrac{1}{6}\,(y^2-1)\, M \qquad (1)$$

Where	U =	capital at risk
	P =	Net Risk Premium
	λ =	Profit loading
	M =	Retention
and	y =	normal variate for a given probability level

A further quick check on the level of aggregate claims may be constructed by assuming that all the claims are equal in size to the retention, and applying a poisson distribution to claim numbers. This gives:

$$\textit{Aggregate Losses} \le Mw \qquad (2)$$

w is the point where $\sum_{r=0}^{w} e^{-n} \frac{n^r}{r\,!}$ first exceeds the desired probability level. This check is only really helpful at small retention levels. Applying these checks to the results for a probability level of 99%, we have:

Table 6 - Reasonableness Checks on H & M Aviation Results

Retention (£000s)	100	1,000	10,000
H & M Capital at Risk	604	5,210	35,431
Compared with (1) above	608	5,585	41,696
H & M Aggregate claims	1,481	12,102	66,253
Compared with (2) above	1,500	15,000	150,000

This confirms the reasonableness of the results for the 99% probability level.

Interpretation of Results - Aviation

The results as presented show that very large amounts of capital would be needed if aviation were insured on a simple risk excess basis unless the retention were very small. Whilst this may be the case for consideration of the self insured deductible for a fleet operator, the actual aviation LMX market is based around some very complicated programmes involving numerous layers, co-insurance, aggregate deductibles, use of top and drops and so on. However, with some additional work, most of these features can be modelled by repeated application of the H & M method, and hence, the effectiveness of particular reinsurance programmes may be assessed.

A2.5 Liability Example (Exhibit 3 Pages 8 to 13)

Tables and graphs of results similar to the aviation example are set out in the exhibits as follows:-

Underlying claim severity distribution - Exhibit 1 Page 2

H&M aggregate claim distribution - Exhibit 3 Page 8

H&M results table - Exhibit 3 Page 9

Graphs of aggregate claim distribution vs retention - Exhibit 3 page 10

Graphs of capital at risk vs retention - Exhibit 3 Page 11

Graphs of capital at risk vs retention as a percentage of gross written premium - Exhibit 3 Page 12

Graphs of capital at risk vs retention as a percentage of net written premium - Exhibit 3 Page 13

Interpretation of Results - Liability

The tables and graphs indicate that relatively high retentions are possible without putting unreasonable amounts of capital at risk. This arises as a consequence of the high profit loading applied to the risk premium coupled with the assumption that there is no parameter uncertainty. It is interesting to note that the capital at risk at the 90% level becomes negative for a retention of 50,000. This means that at that retention and assumed cost of reinsurance, the premium loading is such that a profit can be expected for 9 out of 10 years.

A2.6 Property Example (Exhibit 3 Pages 14 to 19)

Tables and graphs of results similar to the aviation and liability examples are set out in the exhibits as follow:-

Underlying claim severity distribution - Exhibit 1 Page 3

H&M aggregate claim distribution - Exhibit 3 Page 14

H&M results table - Exhibit 3 Page 15

Graphs of aggregate claim distribution vs retention - Exhibit 3 Page 16

Graphs of capital at risk vs retention - Exhibit 3 Page 17

Graphs of capital at risk vs retention as a percentage of gross written premium - Exhibit 3 Page 18

Graphs of capital at risk vs retention as a percentage of net written premium - Exhibit 3 Page 19

Interpretation of Results - Property

As was the case for the liability example, the tables and graphs indicate that relatively high retentions are possible without putting unreasonable amounts of capital at risk. As before, this arises as a consequence of the high profit loading applied to the risk premium coupled with the assumption that there is no parameter uncertainty. The unrealistic loadings applied to the reinsurance risk premiums also reduce the calculated figures for capital at risk.

In this example the capital at risk at the 90% level remains negative for all retentions shown in the results table, although the gross capital at risk is positive. This means that the premium loading is such that a profit can be expected for 9 out of 10 years for any retention of at least up to £1 million. At the 99.9% probability level, the results show positive capital at risk for retentions above £100,000. In a case like this, solvency aspects may not be as important in the analysis as the maximisation of expected profit subject to the cost and availability of reinsurance.

Appendix 3

AN EXAMPLE APPLICATION OF SIMULATION

A3.1 Introduction

This particular example is of a large insurer writing UK personal and commercial lines. The gross retention is acceptable to the company except for the aggregation exposure to weather events such as flood, windstorm and freeze. We shall consider the effect of weather catastrophes on the company. For this purpose, a catastrophe will be defined as any event giving rise to an insured claim in excess of £100 million to the market at 1990 values.

The results of the simulations lead us to the following conclusions for a hypothetical insurance company with a 10% share of the UK property market.

1. The company could reduce the variability of retained claims at no additional cost by purchasing higher layers of excess of loss reinsurance and retaining a greater coinsured share.

2. The company could raise the lower limit of the reinsurance programme. The outwards reinsurance premiums recouped from this could be used to purchase higher layers of reinsurance and reduce the variability of the claim retention.

3. The company could investigate other forms of reinsurance that will achieve the same level of variability at a reduced cost. One such reinsurance could be an annual aggregate stop loss on claims arising from catastrophe events.

4. The company's annual catastrophe excess of loss reinsurance premium is £22 million. The simulations indicate that the expected claim ratio to the reinsurer in the long term is 40%-60%. On this basis the annual long term cost to the company of smoothing their retentions using excess of loss reinsurance is £8.8 - £13.2 million.

5. If the company management are able to advise on their desired variability then the optimum reinsurance programme can be investigated.

A3.2 Methodology

The simulation divides into four parts:-

1. Determination of the model for the gross market claims distribution.

2. Estimation of the parameters for the gross market claims model.

3. Calculation of the effect of individual events on the company concerned.

4. Analysis of the retention strategy required to achieve the target net claims distribution.

A3.3 Model Identification and Parameter Estimation

It is possible to argue that a catastrophe occurrence is a Poisson process. In other words it satisfies:-

1. The probability of an event occurring in a time period t_1 to t_2 is proportional to $(t_2 - t_1)$.

2. The probability of two or more events occurring at the same time or an infinite number of events in a finite period is zero.

3. The events in two disjoint time periods are independent.

If this is so, then the number of occurrences in a year has a Poisson distribution. Notice that for condition 2 to hold a catastrophe must be defined as all claims arising from one event. Counting two aeroplanes that crashed into each other as two events breaks condition 2. Further, the cyclical nature of weather conditions also undermines condition 1.

We commenced by examining the data concerning past losses above £40 million original cost in order to estimate parameters for the frequency and severity distributions. This is shown in Exhibit 4 Page 1. During the 11.5 years of experience there have been 12 claims in excess of £100 million at current costs or approximately one per year.

We decided to use a Pareto distribution to simulate the severity scaling all claims by £100 million. Thus a simulated value of 1.5 would correspond to a market claim of £150 million. The maximum likelihood estimator of the Pareto parameter based upon experience is 0.84. This gives a very skew distribution which has no mean.

This is probably a result of the fact that the sample of twelve claims includes two very large catastrophes which we expect to occur with much lower frequency than once every six years (unless weather patterns have changed significantly, which should be of more immediate concern to those responsible for gross pricing as well as those responsible for reinsurance pricing!). An adjustment to the severity distribution is required to reflect the finite amount of insured property that is at risk. We chose £10 billion as an upper limit to the severity distribution.

Table 7 shows what we consider to be a reasonable range of parameters to use in the simulations.

Table 7 - Simulation Parameters

Frequency	Severity
0.75	1.25
1.00	1.33
1.25	1.50

The combination of three frequency and three severity parameters gives nine possible distributions for the gross catastrophes. The three severity parameters 1.25, 1.33 and 1.5 indicate events such as the 1987 and 1990 storms as being one in thirty, forty or fifty occurrences respectively. That is one every so many events not years. The frequency of these measured in years will depend upon the number of events assumed per year. A low severity parameter has a high probability of yielding very large claims.

The actual simulation can be performed using the U(0,1) random variable function of the spreadsheet package. The practitioner should consider the randomness of the generator. Simple algorithms for the generation of the U(0,1) can be set up if required.

A3.4 The Company's Claims Distributions and Retention Policy

The estimation of a company's gross claim from that of the market has been assumed to follow a linear relationship with market share measured by premium volume. We believe that this is a reasonable approach due to the very high number of relatively homogeneous small units which compose the exposure of a large company. This assumption may not hold for smaller companies who could have very regionalised exposure. More complex methods can be used. A good example is the method described in Section 4.4 and used by some US insurers to estimate hurricane losses. Exhibit 4 Page 2 shows the mean and standard deviation of the aggregate gross annual cost of claims under the simulation for the company in our example on each of the nine bases.

For each set of parameters, a simulation of perhaps five thousand years' of claims should be performed. The higher the number of simulations, the greater the amount of information available concerning the extremes of the aggregate claims distribution. On the other hand, should events that occur once in ten thousand years have a material influence on the management of the operation?

The next stage is to set up a parameterised programme which calculates the net financial impact to the company for each year of simulated claims. The parameters determining the precise details of the reinsurance programme are required. The premiums paid plus reinstatements payable should be included in the costs of the reinsurance. For some purposes it may be best to use current market premium rates, for others an estimate of the mean long term rate chargeable may be better.

The mean of the resulting net claims distribution can be subtracted from that of the gross distribution to indicate the mean claims recovery. This in turn can be compared to the mean cost of the reinsurance including reinstatement premiums. This should demonstrate the cost of reinsurance to the company over the long term.

The aim of the reinsurance however is to reduce the variability of the retained claims distribution. One problem is to determine how to measure this variability. The standard deviation, 95% confidence limit or 99% confidence limit could be used. Again, a benefit of simulation is that any moment of the distribution can be estimated. The advantage of measures such as the standard deviation is that they look at the shape of the whole distribution. Two identical companies with the same capital and probability of losing that capital could have entirely different claims variability due to different reinsurance. As a result, they will experience very different profits. This demonstrates one problem of the probability of loss concepts: they look at only one point in the claims distribution.

It is worth investigating the effect that the truncation of the claim severity has on the measure of variability selected. Table 8 shows the results for a simulation of 5,000 years with a Poisson parameter of 1.25 and a Pareto parameter of 1.25.

Table 8 - Gross Market Catastrophe Claims

	No Truncation	£10 Billion	£5 Billion
Average Annual Cost	549	448	433
SD of Average Annual Cost	2,771	920	753

Clearly, if conclusions are being drawn on the basis of the value of standard deviations it is important to investigate whether the conclusions are the same whatever the truncation point.

We are now ready commence investigation of the retention of the company. As we have touched on earlier, the retention philosophy must come from a consideration of the objectives of the company and may well incorporate shareholder utility curves. These discussions are outside the scope of this section. Here, we shall demonstrate some of the ways in which we can use this work to improve retention decisions.

Our starting point is to assume that the company in question has a catastrophe reinsurance programme covering claims arising from one event for £170 million excess of £30 million. The cover has been 95% placed at an initial cost of £22 million and has unlimited reinstatements paid 100% for time irrespective of the unelapsed exposure and pro-rata to the size of the recovery.

Exhibit 4 Page 3 shows the mean gross and net claims costs for this company for each combination of simulation parameters. The standard deviations are also shown. As expected the reinsurance programme results in a lower coefficient of variation for the net claims distribution than for the gross. Even under the most severe claim assumptions the expected reinsurance recovery net of reinstatements is £13 million against the original premium of £22 million. Can the reinsurance programme be improved without increasing the cost? We can investigate what happens when the height of the layers purchased is changed, both above £30 million and above £200 million. The cost is kept the same by increasing the amount of coinsurance, after all, who said "Placing 100% of the layer is the most efficient thing to do."!?

The graphs in Exhibit 4 Pages 4 to 6 show that with a fixed lower limit the standard deviation of the net claims reduces as the upper limit is raised! Further, raising the lower limit also reduces the standard deviation as is shown in Exhibit 4 Page 7. Perhaps the result of this is that companies should be encouraged to take higher layers of cover with more coinsurance? This will provide a reduction in the standard deviation of the retained claims at no additional cost.

We have concentrated, thus far, on one type of reinsurance. The variability that we are trying to control is the standard deviation of the retained catastrophe claims in one year. So why are we considering a reinsurance programme focusing on each event? What about an aggregate stop loss contract that caps the aggregate claims from all catastrophe events in the year? In order to perform a full analysis of this, the company would have to obtain quotes for this insurance.

The simulation allows us to investigate the levels of variability that would result from such contracts. These variabilities are shown in Exhibit 4 Page 8 for a stop loss of £100 million xs £50 million. The results look very promising. This is not wholly surprising since this reinsurance protects against frequency as well as severity of catastrophe.

We have not really discussed which of the nine sets of parameters we consider to be the most appropriate. The main reason for this is that our conclusions have been non-parametric. The results have held for all nine combinations. Exhibit 4 Pages 9 and 10 shows a hundred year simulation of catastrophes under each of these nine combinations. We hope that you will agree, based on your experience of UK weather claims, that they cover a reasonable range from the optimistic to the pessimistic.

Finally, a word of caution: we have used the standard deviation as a measure of variability. Exhibit 4 Page 11 compares the actual 95% and 99% confidence limits for the simulated net claims with the same limits estimated using the normal approximation. There are very considerable differences which demonstrate the skewness of these distributions and the care required when interpreting simulation results.

On the same note, examination of simulation results in Exhibit 4 Page 2 shows that the most severe set of claim assumptions, Pareto 1.25 and Poisson 1.25, do not have the highest standard deviation. The Pareto 1.33 and Poisson 1.25 standard deviation is higher. This could either be a genuine result, a random variation in the simulation or an effect of capping the claim severity distribution. If the same sample of U(0,1) variables are used for both sets of simulations then the Pareto 1.25 and Poisson 1.25 has the highest standard deviation. This is shown in Table 9 below:-

Table 9 - Comparison of Simulations (£ millions)

Simulation Parameters	Simulation Mean	Simulation Standard Deviation
* Pareto 1.33 Poisson 1.25	421	940
* Pareto 1.25 Poisson 1.25	448	920
+ Pareto 1.25 Poisson 1.25	469	1,064

* As shown in Exhibit 4 Page 2.

\+ Calculated using the U(0,1) variables from the simulation of Pareto 1.33 and Poisson 1.25 in Exhibit 4 Page 2.

It would appear that the results arose from random variations in the simulation.

APPENDIX 4

EXAMPLE APPLICATIONS OF THE RECURSIVE METHOD

A4.1 Introduction

We have applied the recursive method to the aviation and liability data sets in order to estimate the aggregate claims distributions. The property data set is so large that we would not recommend the use of the recursive method. There are two reasons for this: first, the normal approximation should be reasonably robust when used with such a high number of claims; second, if the number of claims assumed for the future is very high then the computation of the aggregate claims distribution using the recursive formula becomes arduous.

A4.2 Methodology

The data sets are rescaled. The rescaled data points are then rounded to the nearest integer. This results in an approximation for the severity distribution. Essentially, the continuous severity distribution is substituted by a mass function on the first few dozen integers. We input the empirical severity distributions as implied by the data. An alternative approach would be to fit one of the classical distributions to the data before scaling and grouping the severities for use in the recursive formula.

The choice of scaling factor represents a trade-off. If the scaling factor chosen is too small, then the number of mass points for the proxy distribution is large, and the application of the recursive formula becomes more difficult. However, if the scaling factor is too large the recursive formula may be more easily applied, but the proxy distribution may not reflect all the characteristics of the parent distribution from which it is derived.

Fortunately, this process is quite robust in that the accuracy gained at having three hundred mass points rather than forty, say, is outweighed by the added computational complexity when applying the recursive formula. The scaled data sets are shown in Exhibit 5 Pages 1 and 2.

We assumed a Poisson distribution for claim frequency taking the number of claims as assumed in Appendices 2 and 3 as the estimate of the mean of the distribution.

A4.3 Aviation Example

Exhibit 5 Page 3 shows graphs of various classical points on the aggregate claims distribution against the per risk claim retention. These graphs are directly comparable to those produced by the H & M method as shown in Exhibit 3 Page 4.

A4.4 Liability Example

Exhibit 5 Page 4 shows graphs of various classical points on the aggregate claims distribution against the per risk claim retention. These graphs are directly comparable to those produced by the H & M method as shown in Exhibit 3 Page 10.

A4.5 Property Example

For the reasons outlined above, we used the normal approximation on this data set. Exhibit 5 Page 5 shows graphs of various classical points on the aggregate claims distribution against the per risk claim retention. These graphs can be compared to those produced by the H & M method as shown in Exhibit 3 Page 16 in order to assess the reasonableness of normal approximation.

Section 8

EXHIBITS

Exhibit 3 - Exhibits for Appendix 2

Exhibit 5 - Exhibits for Appendix 4

Reinsurance and Retentions Working Party
Sample Data Distribution Used in Examples
Aviation LMX
Amounts in £000s

Claim Amount	Probability Point
22	2.439%
35	4.878%
235	7.317%
236	9.756%
244	12.195%
280	14.634%
332	17.073%
332	19.512%
338	21.951%
360	24.390%
598	26.829%
666	29.268%
693	31.707%
723	34.146%
750	36.585%
766	39.024%
795	41.463%
997	43.902%
1,006	46.341%
1,035	48.780%
1,080	51.220%
1,615	53.659%
2,507	56.098%
2,635	58.537%
2,635	60.976%
3,622	63.415%
3,832	65.854%
4,042	68.293%
4,551	70.732%
4,868	73.171%
5,800	75.610%
6,247	78.049%
8,865	80.488%
15,714	82.927%
20,160	85.366%
24,670	87.805%
25,587	90.244%
49,912	92.683%
52,211	95.122%
83,445	97.561%

Severity Mean = 9175

Claim Frequency Distribution = Poisson

Mean Claims Per Year = 8.000

Reinsurance and Retentions Working Party
Sample Data Distribution Used in Examples
Liability
Amounts in £s

Claim Amount	Probability Point
46	0.16%
210	2.03%
464	3.91%
604	5.79%
726	7.67%
864	9.55%
1,005	11.42%
1,168	13.30%
1,366	15.18%
1,542	17.06%
1,689	18.94%
1,843	20.81%
1,996	22.69%
2,218	24.57%
2,342	26.45%
2,545	28.33%
2,773	30.20%
3,135	32.08%
3,423	33.96%
3,880	35.84%
4,094	37.72%
4,458	39.59%
4,922	41.47%
5,252	43.35%
5,678	45.23%
6,104	47.10%
6,268	48.98%
6,917	50.86%
7,560	52.74%
8,024	54.62%
8,685	56.49%
9,763	58.37%
10,648	60.25%
11,784	62.13%
13,018	64.01%
14,054	65.88%
15,421	67.76%
17,940	69.64%
19,019	71.52%
21,568	73.40%
23,442	75.27%
25,230	77.15%
27,479	79.03%
30,405	80.91%
34,021	82.79%
37,906	84.66%
44,741	86.54%
58,040	88.42%
71,214	90.30%
91,109	92.18%
136,713	94.05%
199,848	95.93%
282,685	97.81%
291,012	97.97%
302,705	98.12%
384,537	98.28%
386,191	98.44%
388,151	98.59%
390,770	98.75%
508,880	98.90%
818,551	99.06%
835,373	99.22%
854,870	99.37%
975,428	99.53%
1,151,688	99.69%
1,756,234	99.84%
2,275,973	99.90%

Severity Mean = 38,134

Claim Frequency Distribution = Poisson

Mean Claims Per Year = 262.233

Reinsurance and Retentions Working Party
Sample Data Distribution Used in Examples
Property
Amounts in £s

Claim Amount	Probability Point	Claim Amount	Probability Point
0	0.01%	32,390	98.87%
20	6.59%	32,930	98.91%
30	13.18%	34,130	98.95%
50	19.77%	36,630	99.00%
70	26.36%	38,530	99.04%
90	32.95%	39,740	99.09%
120	39.53%	42,920	99.13%
170	46.12%	45,000	99.17%
220	52.71%	46,660	99.22%
270	59.30%	48,480	99.26%
370	65.88%	50,080	99.30%
510	72.47%	51,540	99.35%
760	79.06%	53,840	99.39%
830	80.16%	56,250	99.44%
900	81.25%	60,150	99.48%
980	82.35%	67,290	99.52%
1,070	83.45%	72,370	99.57%
1,200	84.55%	77,400	99.61%
1,330	85.65%	93,070	99.66%
1,500	86.74%	117,940	99.70%
1,710	87.84%	122,760	99.71%
1,990	88.94%	131,250	99.71%
2,290	90.04%	132,210	99.72%
2,700	91.14%	134,780	99.73%
3,140	92.23%	143,440	99.74%
3,750	93.33%	144,740	99.74%
4,590	94.43%	148,820	99.75%
6,130	95.53%	149,540	99.76%
8,540	96.63%	150,000	99.77%
11,090	97.37%	153,600	99.78%
11,250	97.42%	153,940	99.79%
11,420	97.46%	165,000	99.80%
11,530	97.50%	168,750	99.80%
11,720	97.55%	186,880	99.81%
12,070	97.59%	187,500	99.82%
12,440	97.64%	192,450	99.82%
12,620	97.68%	194,580	99.83%
12,850	97.72%	214,990	99.84%
13,080	97.77%	222,240	99.85%
13,360	97.81%	225,000	99.85%
13,820	97.86%	234,250	99.86%
14,210	97.90%	234,800	99.87%
14,490	97.94%	247,220	99.88%
14,780	97.99%	248,000	99.88%
15,000	98.03%	305,650	99.89%
15,480	98.07%	313,440	99.90%
15,750	98.12%	326,630	99.90%
16,160	98.16%	334,860	99.91%
16,490	98.21%	375,000	99.92%
16,960	98.25%	381,080	99.93%
17,670	98.29%	427,500	99.93%
18,730	98.34%	450,000	99.94%
19,650	98.38%	549,600	99.95%
20,270	98.43%	601,230	99.96%
21,170	98.47%	626,700	99.96%
22,030	98.51%	1,117,730	99.97%
22,760	98.56%	1,261,060	99.98%
24,290	98.60%	3,753,050	99.99%
25,110	98.65%	4,305,000	99.99%
26,250	98.69%		
26,580	98.73%		
28,130	98.78%		
30,180	98.82%		

Severity Mean = 2956.1

Claim Frequency Distribution = Poisson

Mean Claims Per Year = 13661

Straub's Method – Aviation Example

Retention vs Capital at Risk for Quota Share

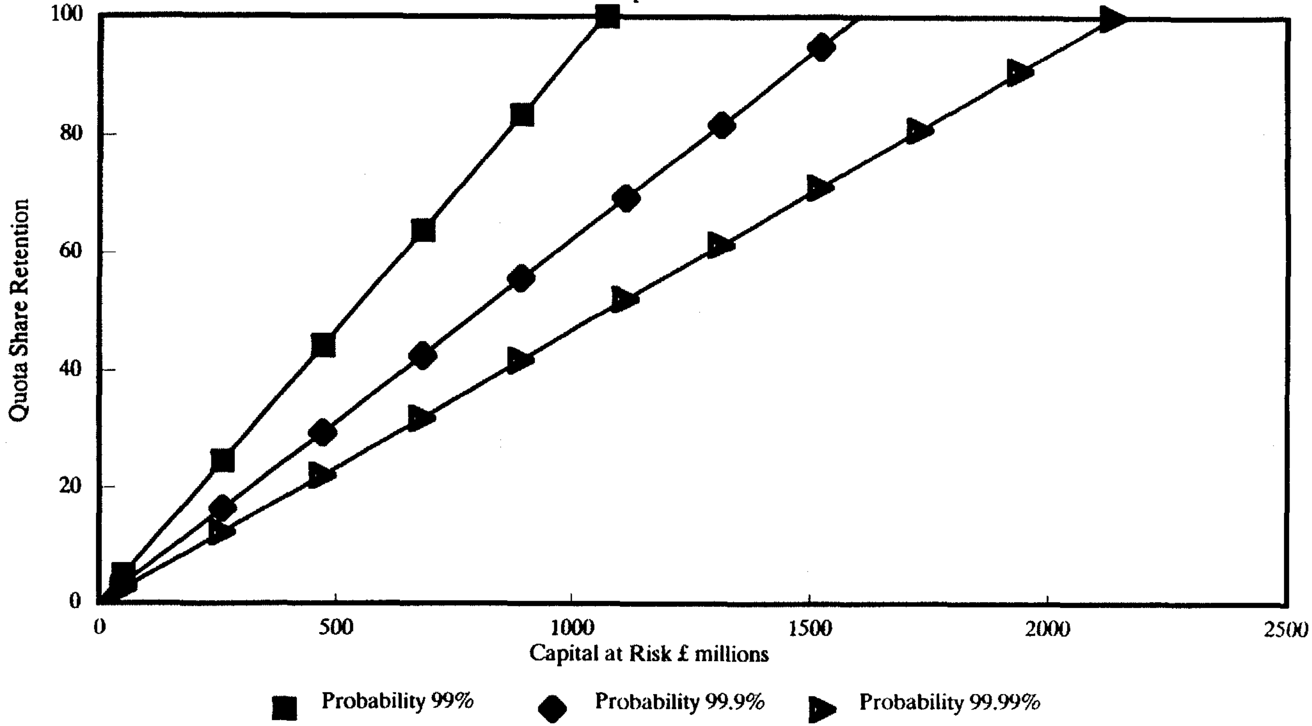


Exhibit 2
Page 1

Straub's Method – Aviation Example

Retention vs Capital at Risk for Risk XL

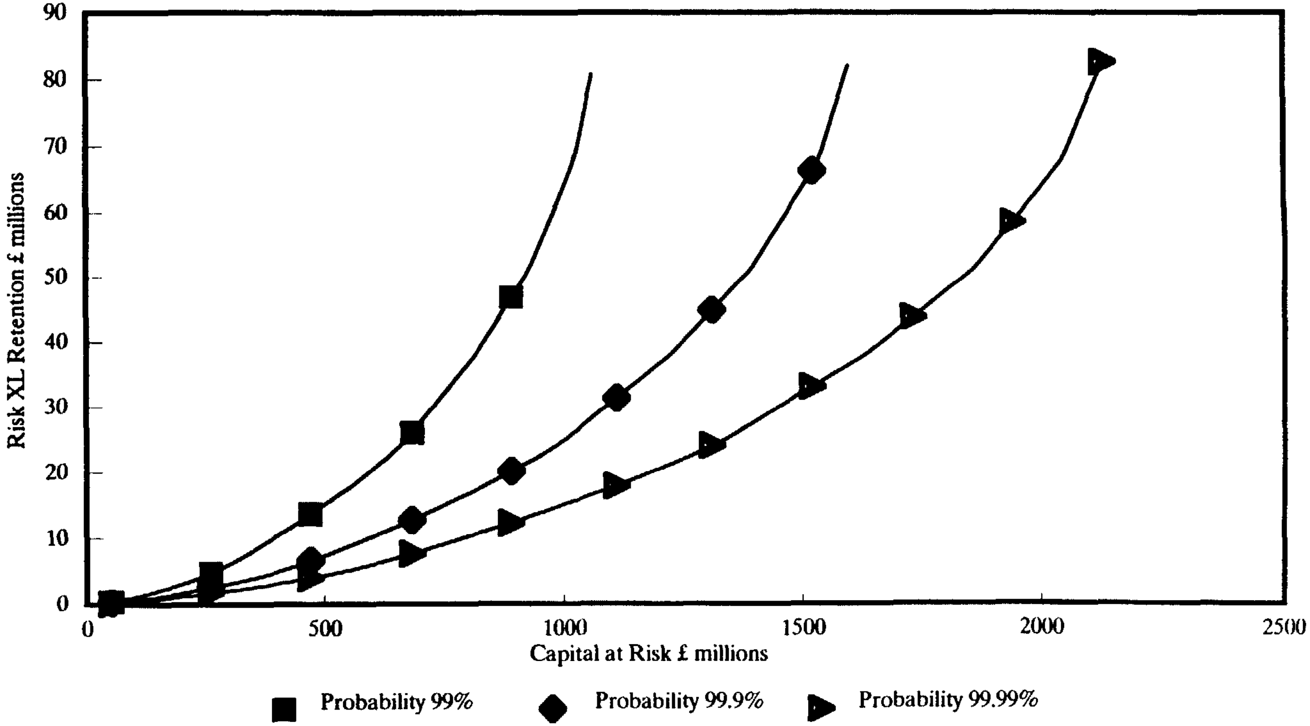


Exhibit 2
Page 2

Straub's Method - Aviation Example

Assumptions

Reference........................ Aviation example
Claim amount dist'n...............User Defined
Claim number dist'n...............Poisson
Total Gross Premiums(M)...........104.9
Capital at risk(M)................62.9
Total Loading in prems(%).........30
Profit Loading(%).................10
Probability (1 in ...)............1000
Reinsurance type.................. Quota Share

Summary statistics

Claim amount Average.............9174719
Claim amount CV..................2.01
Number of claims.................8
Aggregate claim average..........73430000
Aggregate claim CV...............0.79

Results

The above assumptions imply Retention = 3%

For different Probabilities:-

Probability (1 in ...)	Retention
1,000	Retention = 3%
100,000	Retention = 2%
1,000,000	Retention = 1%
100,000,000	Retention = 1%
1,000,000,000	Retention = 1%

For different Capital at risk:-

Capital at risk As % prem	Amount(M)	Retention
5%	5.25	Retention = 0%
18%	18.88	Retention = 1%
100%	104.90	Retention = 6%
500%	524.50	Retention = 32%
1000%	1049.00	Retention = 65%

Straub's Method - Aviation Example

Assumptions

Reference........................ Aviation example
Claim amount dist'n..............User Defined
Claim number dist'n..............Poisson
Total Gross Premiums(M)...........104.9
Capital at risk(M)................62.9
Total Loading in prems(%).........30
Profit Loading(%).................10
Probability (1 in ...)...........1000
Reinsurance type.................. Risk XL

Summary statistics

Claim amount Average.............9174719
Claim amount CV..................2.01
Number of claims.................8
Aggregate claim average..........73430000
Aggregate claim CV...............0.79

Results

The above assumptions imply Retention = 404796

For different Probabilities:-

Probability (1 in ...)	Retention
1,000	Retention = 404796
100,000	Retention = 228819
1,000,000	Retention = 189917
100,000,000	Retention = 141289
1,000,000,000	Retention = 125335

For different Capital at risk:-

Capital at risk As % prem	Amount(M)	Retention
5%	5.25	Retention = 30594
18%	18.88	Retention = 112772
100%	104.90	Retention = 737865
500%	524.50	Retention = 8119757
1000%	1049.00	Retention = 27613906

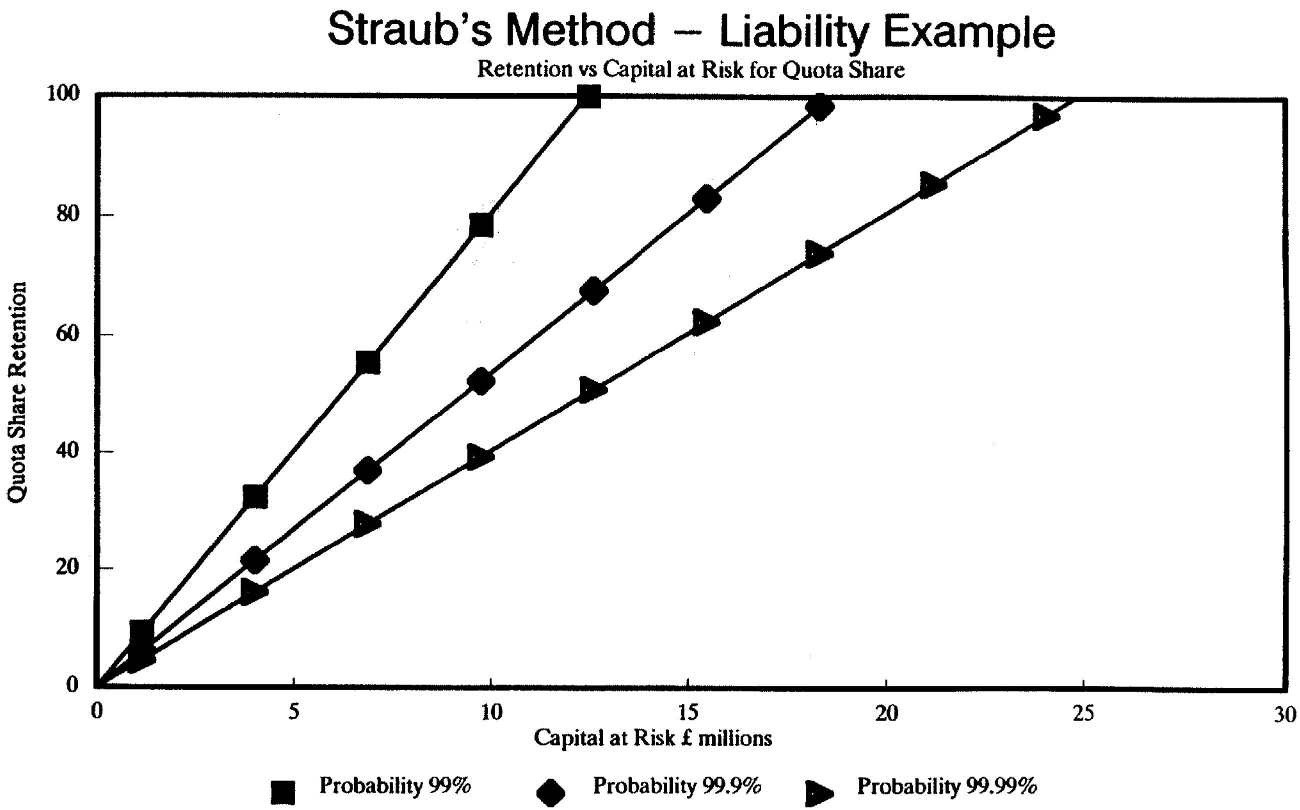


Exhibit 2
Page 5

Straub's Method – Liability Example

Retention vs Capital at Risk for Risk XL

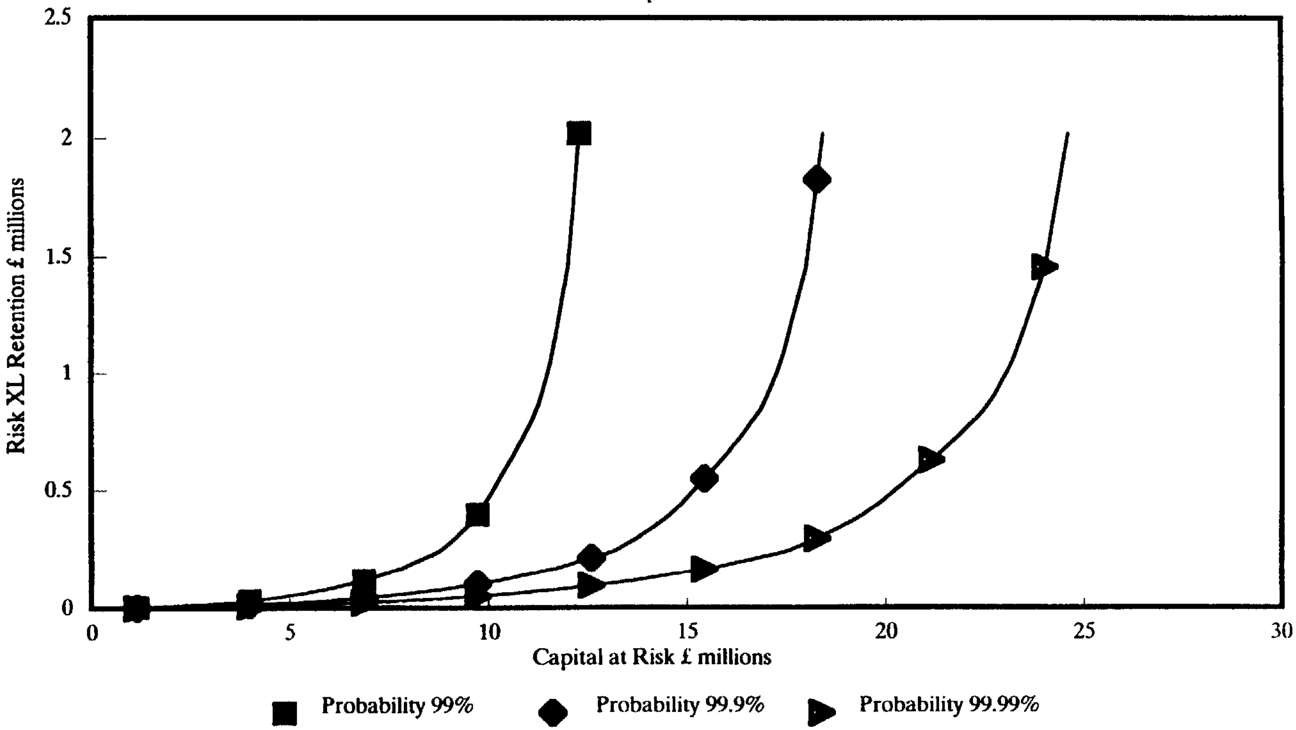


Exhibit 2
Page 6

Straub's Method - Liability Example

Assumptions

Reference........................ Liability example
Claim amount dist'n..............User Defined
Claim number dist'n..............Poisson
Total Gross Premiums(M)..........14.3
Capital at risk(M)...............8.6
Total Loading in prems(%).........30
Profit Loading(%)................10
Probability (1 in ...)...........1000
Reinsurance type................. Quota Share

Summary statistics

Claim amount Average.............38133
Claim amount CV..................3.62
Number of claims.................262.5
Aggregate claim average..........10010000
Aggregate claim CV...............0.23

Results

The above assumptions imply Retention = 46%

For different Probabilities:-

Probability (1 in ...)	Retention
1,000	Retention = 46%
100,000	Retention = 27%
1,000,000	Retention = 23%
100,000,000	Retention = 17%
1,000,000,000	Retention = 15%

For different Capital at risk:-

Capital at risk As % prem	Amount(M)	Retention
5%	0.72	Retention = 3%
18%	2.57	Retention = 13%
100%	14.30	Retention = 76%
500%	71.50	No Quota Share reinsurance required!
1000%	143.00	No Quota Share reinsurance required!

Straub's Method - Liability Example

Assumptions

Reference........................ Liability example
Claim amount dist'n...............User Defined
Claim number dist'n...............Poisson
Total Gross Premiums(M)...........14.3
Capital at risk(M)................8.6
Total Loading in prems(%).........30
Profit Loading(%).................10
Probability (1 in ...)............1000
Reinsurance type.................. Risk XL

Summary statistics

Claim amount Average.............38133
Claim amount CV..................3.62
Number of claims.................262.5
Aggregate claim average..........10010000
Aggregate claim CV...............0.23

Results

The above assumptions imply Retention = 75178

For different Probabilities:-

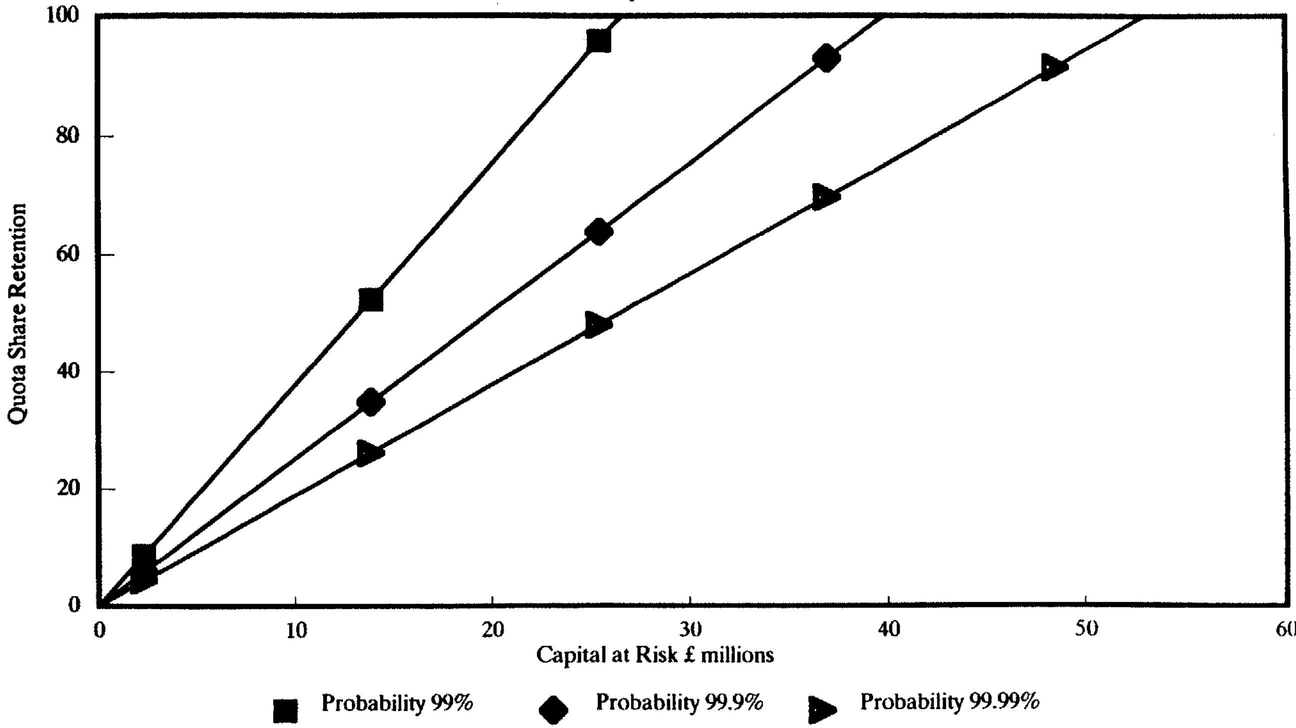
Probability (1 in ...)	Retention
1,000	Retention = 75178
100,000	Retention = 24110
1,000,000	Retention = 17610
100,000,000	Retention = 11137
1,000,000,000	Retention = 9327

For different Capital at risk:-

Capital at risk As % prem	Amount(M)	Retention
5%	0.72	Retention = 1606
18%	2.57	Retention = 7959
100%	14.30	Retention = 359715
500%	71.50	No Risk XL reinsurance required!
1000%	143.00	No Risk XL reinsurance required!

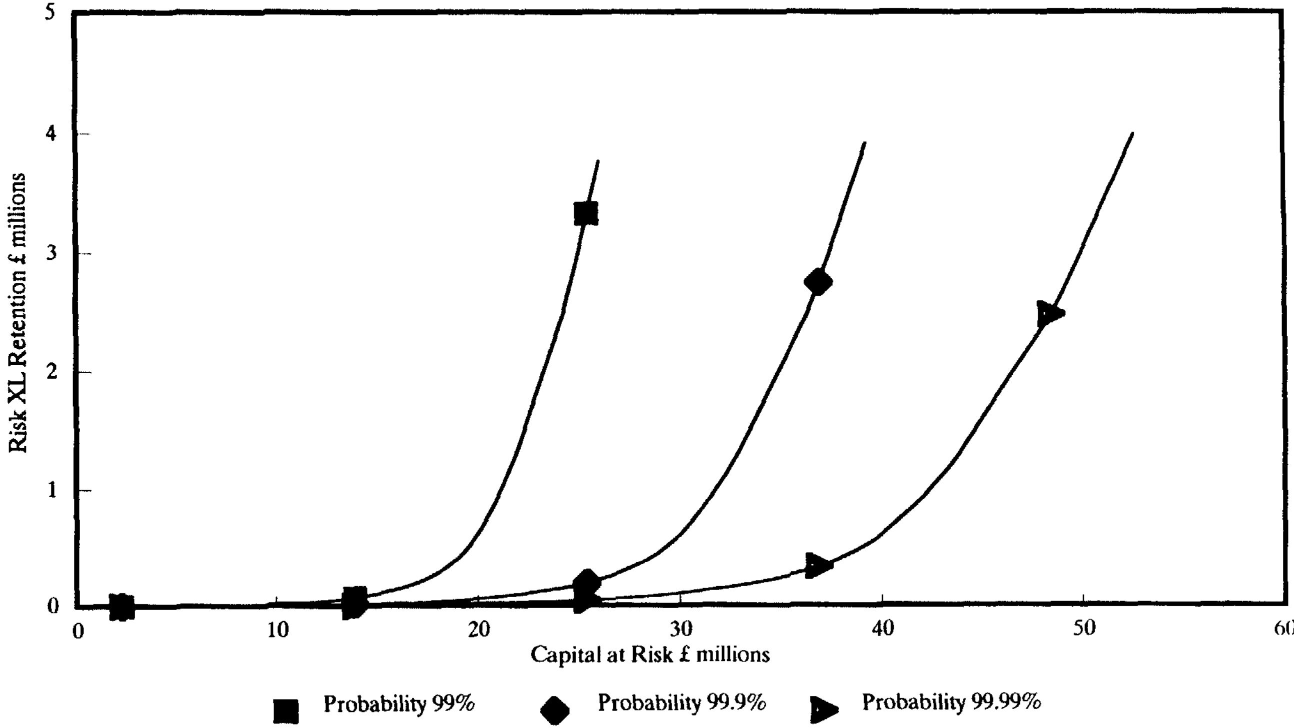
Straub's Method – Property Example

Retention vs Capital at Risk for Quota Share



Straub's Method – Property Example

Retention vs Capital at Risk for Risk XL



Straub's Method - Property Example

Assumptions

Reference........................ Property example
Claim amount dist'n..............User Defined
Claim number dist'n..............Poisson
Total Gross Premiums(M)..........57.7
Capital at risk(M)...............34.6
Total Loading in prems(%)........30
Profit Loading(%)................10
Probability (1 in ...)...........1000
Reinsurance type................. Quota Share

Summary statistics

Claim amount Average.............2956
Claim amount CV..................19.7
Number of claims.................13659.44
Aggregate claim average..........40390000
Aggregate claim CV...............0.17

Results

The above assumptions imply Retention = 87%

For different Probabilities:-

Probability (1 in ...)	Retention
1,000	Retention = 87%
100,000	Retention = 52%
1,000,000	Retention = 43%
100,000,000	Retention = 32%
1,000,000,000	Retention = 29%

For different Capital at risk:-

Capital at risk As % prem	Amount(M)	Retention
5%	2.89	Retention = 7%
18%	10.39	Retention = 26%
100%	57.70	No Quota Share reinsurance required!
500%	288.50	No Quota Share reinsurance required!
1000%	577.00	No Quota Share reinsurance required!

Straub's Method - Property Example

Assumptions

Reference........................ Property example
Claim amount dist'n..............User Defined
Claim number dist'n..............Poisson
Total Gross Premiums(M)..........57.7
Capital at risk(M)...............34.6
Total Loading in prems(%).........30
Profit Loading(%)................10
Probability (1 in ...)...........1000
Reinsurance type.................Risk XL

Summary statistics

Claim amount Average.............2956
Claim amount CV..................19.7
Number of claims.................13659.44
Aggregate claim average..........40390000
Aggregate claim CV...............0.17

Results

The above assumptions imply Retention = 1874895

For different Probabilities:-

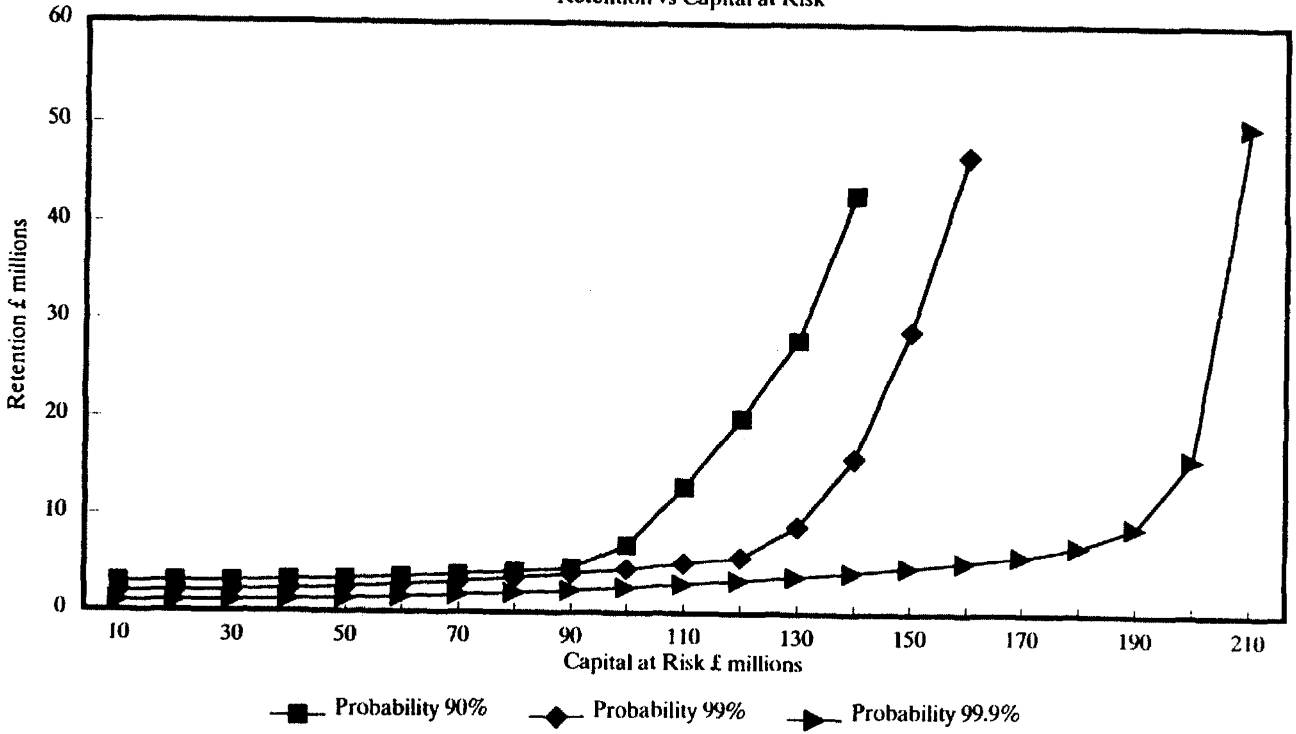
Probability (1 in ...)	Retention
1,000	Retention = 1874895
100,000	Retention = 69274
1,000,000	Retention = 32947
100,000,000	Retention = 12044
1,000,000,000	Retention = 8336

For different Capital at risk:-

Capital at risk As % prem	Amount(M)	Retention
5%	2.89	Retention = 392
18%	10.39	Retention = 6181
100%	57.70	No Risk XL reinsurance required!
500%	288.50	No Risk XL reinsurance required!
1000%	577.00	No Risk XL reinsurance required!

Heckman and Meyers' Method – Example

Retention vs Capital at Risk



Heckman and Meyers' Method - Aviation Example
Aggregate Claims Distribution

Aggregate Mean	Claim Severity Distribution	Contagion Parameter	Claim Freq. Mean	Claim Freq. Std Dev	
73398		0.0000	8.000	2.828	
Mixing Parameter	**Aggregate Mean**	**Aggregate Std Dev**	**H**	**Number Of Intervals**	**Est Trunc Er In EPP Ratio**
0.00%	73,398	58,553	0.8350	134	0.000008

Aggregate Claim Amount	Entry Ratio	Cumulative Probability	Excess Pure Premium	Excess Pure Premium Ratio
7,340	0.10000	6.46%	66,252	90.3%
14,680	0.20000	15.42%	59,726	81.4%
22,019	0.30000	21.91%	53,769	73.3%
29,359	0.40000	28.12%	48,257	65.8%
36,699	0.50000	34.49%	43,222	58.9%
44,039	0.60000	39.39%	38,602	52.6%
51,378	0.70000	43.42%	34,303	46.7%
58,718	0.80000	48.26%	30,323	41.3%
66,058	0.90000	52.97%	26,704	36.4%
73,398	1.00000	56.89%	23,399	31.9%
80,738	1.10000	60.62%	20,371	27.8%
88,077	1.20000	64.84%	17,627	24.0%
95,417	1.30000	69.56%	15,223	20.7%
102,757	1.40000	73.40%	13,135	17.9%
110,097	1.50000	76.72%	11,306	15.4%
117,436	1.60000	79.84%	9,715	13.2%
124,776	1.70000	82.40%	8,332	11.4%
132,116	1.80000	84.51%	7,120	9.7%
139,456	1.90000	86.50%	6,055	8.3%
146,796	2.00000	88.38%	5,135	7.0%
161,475	2.20000	91.30%	3,655	5.0%
176,155	2.40000	93.74%	2,561	3.5%
190,834	2.60000	95.56%	1,784	2.4%
205,514	2.80000	96.87%	1,234	1.7%
220,193	3.00000	97.78%	845	1.2%
234,873	3.20000	98.46%	572	0.8%
249,552	3.40000	98.94%	383	0.5%
264,232	3.60000	99.29%	255	0.4%
278,911	3.80000	99.52%	168	0.2%
293,591	4.00000	99.68%	110	0.2%
308,271	4.20000	99.79%	72	0.1%
322,950	4.40000	99.86%	46	0.1%
337,630	4.60000	99.91%	30	0.0%
352,309	4.80000	99.94%	19	0.0%
366,989	5.00000	99.96%	12	0.0%
381,668	5.20000	99.98%	7	0.0%
396,348	5.40000	99.99%	5	0.0%
411,027	5.60000	99.99%	3	0.0%
425,707	5.80000	99.99%	2	0.0%
440,387	6.00000	100.00%	1	0.0%

Heckman and Meyers' Method - Aviation Example

Retention	Net Aggregate Claims 90%	Net Aggregate Claims 99%	Net Aggregate Claims 99.9%	Mean	Reinsurance Risk Premium	Reinsurance Premium Net of Expenses	Premium Net of Reinsurance and Expenses
Infinity	154,940	252,069	333,960	73,398	0	0	83,883
75,000	149,531	240,757	319,190	71,527	1,871	2,138	81,746
50,000	125,913	199,173	260,325	63,186	10,212	11,671	72,213
25,000	85,422	129,077	164,548	46,028	27,370	31,280	52,603
15,000	60,711	88,903	112,555	34,256	39,142	44,733	39,150
10,000	46,002	66,253	82,448	26,969	46,429	53,062	30,822
5,000	30,001	41,930	51,304	18,417	54,981	62,835	21,048
1,000	9,110	12,102	14,472	6,030	67,368	76,992	6,892
500	5,138	6,778	8,071	3,452	69,946	79,938	3,945
100	1,130	1,481	1,755	767	72,631	83,007	877

Retention	Capital at Risk 90%	Capital at Risk 99%	Capital at Risk 99.9%
Infinity	71,057	168,186	250,077
75,000	67,785	159,011	237,444
50,000	53,700	126,960	188,112
25,000	32,819	76,474	111,945
15,000	21,561	49,753	73,405
10,000	15,180	35,431	51,626
5,000	8,953	20,882	30,256
1,000	2,218	5,210	7,580
500	1,193	2,833	4,126
100	253	604	878

Retention	Capital at Risk as a Percentage of Total Gross Premium 90%	99%	99.9%	Retention
Infinity	67.77	160.40	238.50	Infinity
75,000	64.65	151.65	226.45	71.53
50,000	51.21	121.08	179.40	47.69
25,000	31.30	72.93	106.76	23.84
15,000	20.56	47.45	70.01	14.31
10,000	14.48	33.79	49.24	9.54
5,000	8.54	19.92	28.86	4.77
1,000	2.12	4.97	7.23	0.95
500	1.14	2.70	3.93	0.48
100	0.24	0.58	0.84	0.10

Retention	Capital at Risk as a Percentage of Net Premium 90%	99%	99.9%	Retention
Infinity	67.77	160.40	238.50	Infinity
75,000	66.34	155.62	232.38	73.40
50,000	59.49	140.65	208.40	55.39
25,000	49.91	116.30	170.25	38.02
15,000	44.06	101.67	150.00	30.65
10,000	39.40	91.96	134.00	25.96
5,000	34.03	79.37	115.00	19.00
1,000	25.75	60.49	88.00	11.61
500	24.19	57.44	83.66	10.14
100	23.13	55.16	80.17	9.13

Total Gross Premium = 104,854
Total Loading in Premiums = 30%
Expense Element of Premium = 20%

Capital at Risk = Net Aggregate Claims - Premium Net of Reinsurance and Expenses

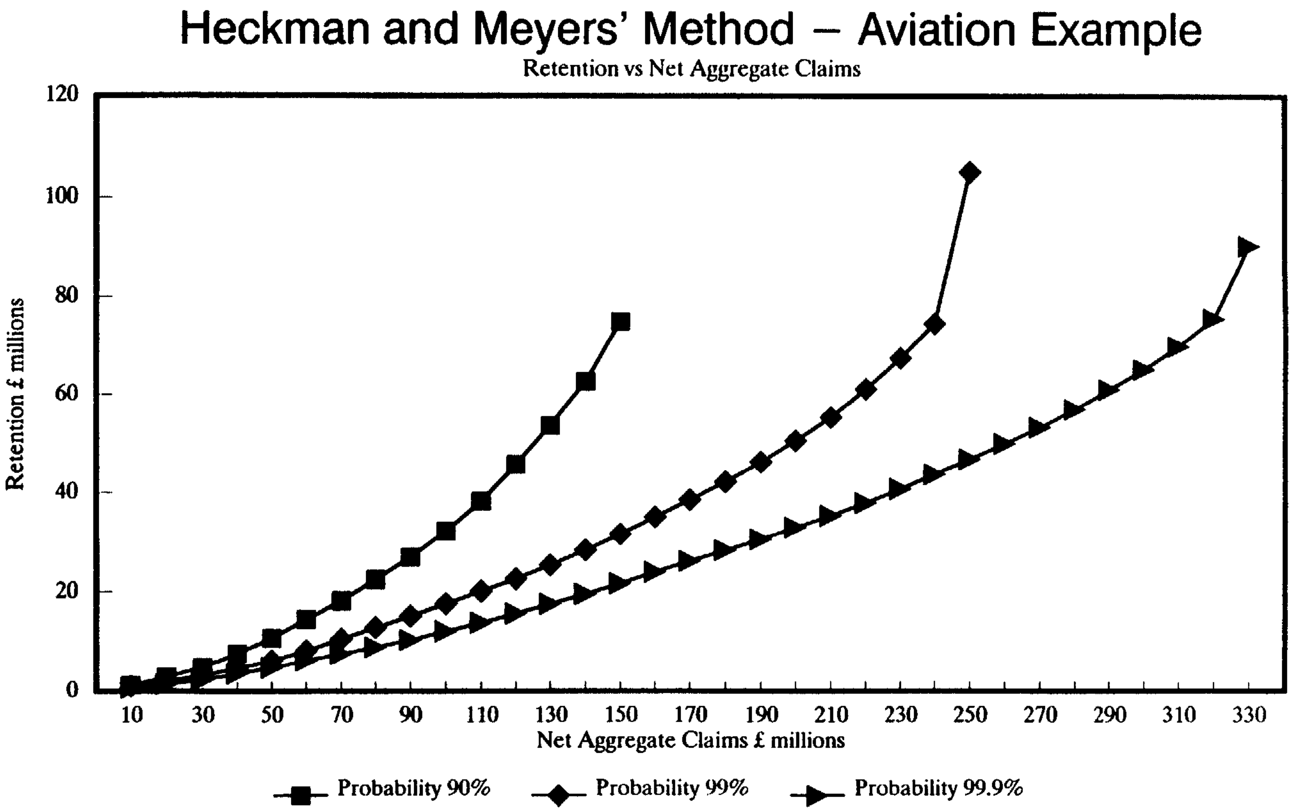
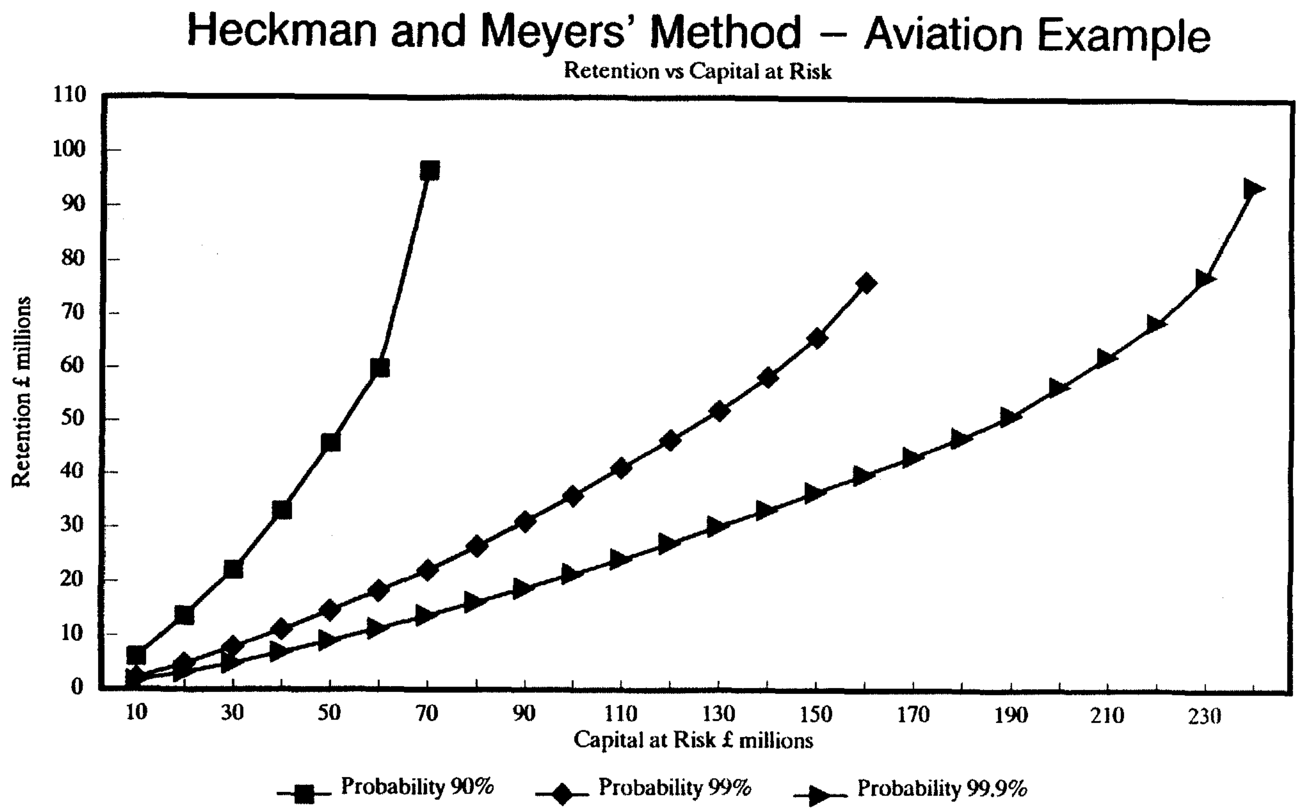


Exhibit 3
Page 4


Heckman and Meyers' Method – Aviation Example
Retention vs Capital at Risk
Retention £ millions
0
10
20
30
40
50
60
70
80
90
100
110
10
30
50
70
90
110
130
150
170
190
210
230
Capital at Risk £ millions
Probability 90%
Probability 99%
Probability 99.9%

Heckman and Meyers' Method – Aviation Example

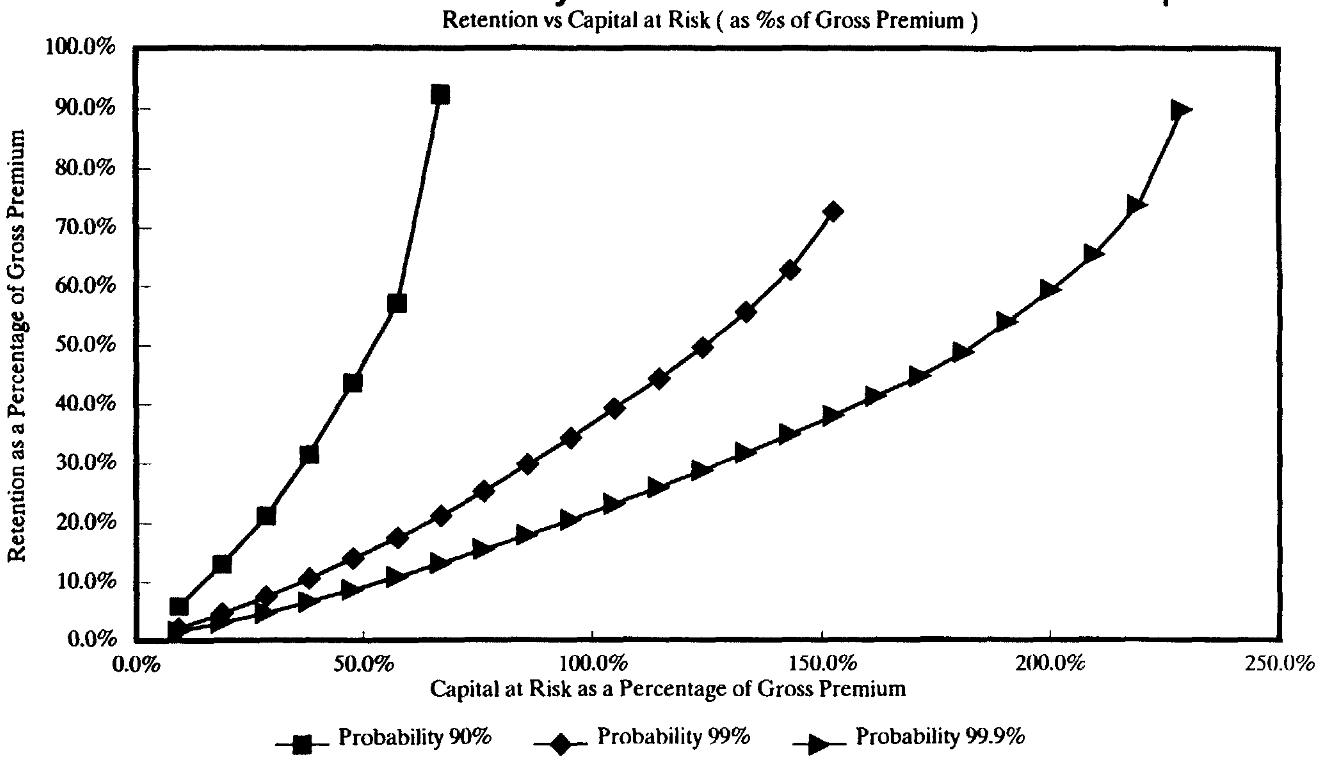
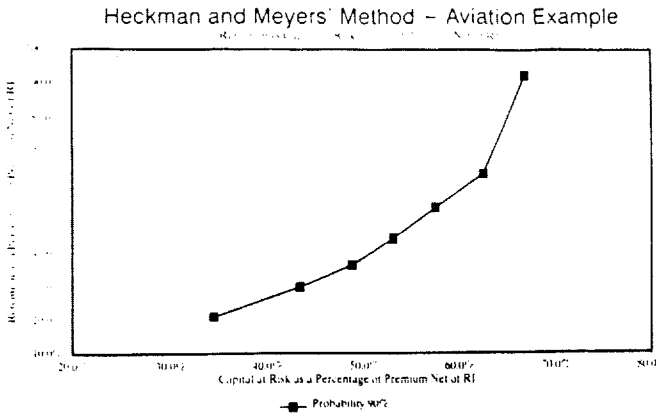
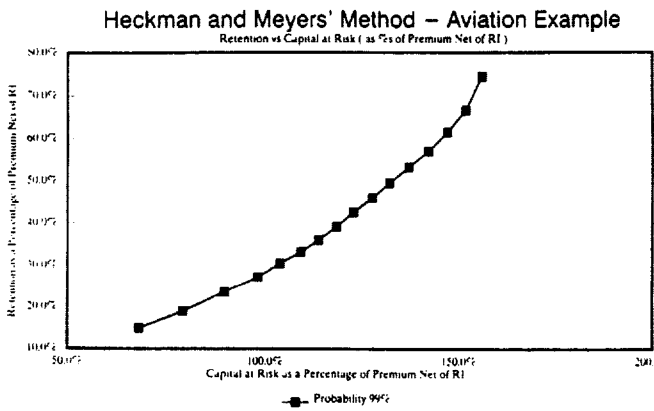
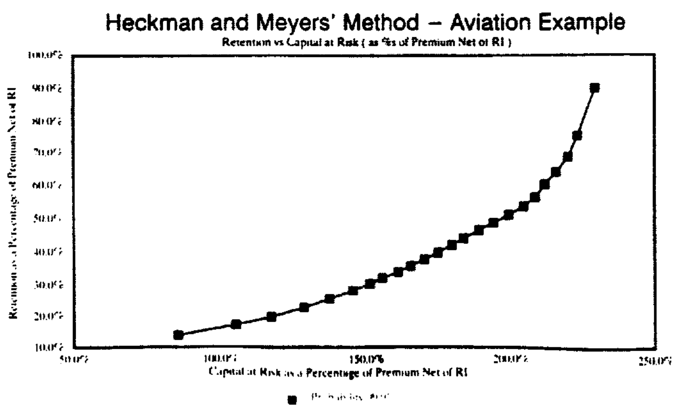


Exhibit 3
Page 6


Heckman and Meyers' Method – Aviation Example
40.0%
50.0%
60.0%
Capital at Risk as a Percentage of Premium Net of RI
Probability 90%


Heckman and Meyers' Method – Aviation Example
Retention vs Capital at Risk (as % of Premium Net of RI)
80.0%
70.0%
60.0%
50.0%
40.0%
30.0%
20.0%
10.0%
50.0%
100.0%
150.0%
200.0%
Retention as a Percentage of Premium Net of RI
Capital at Risk as a Percentage of Premium Net of RI
Probability 99%


Heckman and Meyers' Method – Aviation Example
Retention vs Capital at Risk (as % of Premium Net of RI)
100.0%
90.0%
80.0%
70.0%
60.0%
50.0%
40.0%
30.0%
20.0%
10.0%
50.0%
100.0%
150.0%
200.0%
250.0%
Retention as a Percentage of Premium Net of RI
Capital at Risk as a Percentage of Premium Net of RI

Heckman and Meyers' Method - Liability Example

Retention	Net Aggregate Claims 90%	Net Aggregate Claims 99%	Net Aggregate Claims 99.9%	Mean	Reinsurance Risk Premium	Reinsurance Premium Net of Expenses	Premium Net of Reinsurance and Expenses
Infinity	13,126,253	16,438,356	19,000,000	10,000,000	0	0	11,428,571
2,000,000	12,913,981	16,049,921	18,593,955	9,916,776	83,224	95,113	11,333,458
1,500,000	12,478,817	15,287,212	17,455,986	9,697,770	302,230	345,406	11,083,166
1,000,000	11,774,667	14,103,513	15,929,301	9,301,782	698,218	797,963	10,630,608
500,000	9,918,055	11,493,230	12,862,369	8,173,411	1,826,589	2,087,530	9,341,041
250,000	8,381,349	9,599,945	10,490,672	7,099,776	2,900,224	3,314,542	8,114,030
100,000	5,966,927	6,625,811	7,142,855	5,165,027	4,834,973	5,525,683	5,902,888
50,000	4,376,672	4,782,366	5,090,672	3,905,886	6,094,114	6,964,702	4,463,870

Retention	Capital at Risk 90%	Capital at Risk 99%	Capital at Risk 99.9%
Infinity	1,697,682	5,009,785	7,571,429
2,000,000	1,580,523	4,716,463	7,260,497
1,500,000	1,395,651	4,204,046	6,372,820
1,000,000	1,144,059	3,472,905	5,298,693
500,000	577,014	2,152,189	3,521,328
250,000	267,319	1,485,915	2,376,642
100,000	64,039	722,923	1,239,967
50,000	(87,198)	318,496	626,802

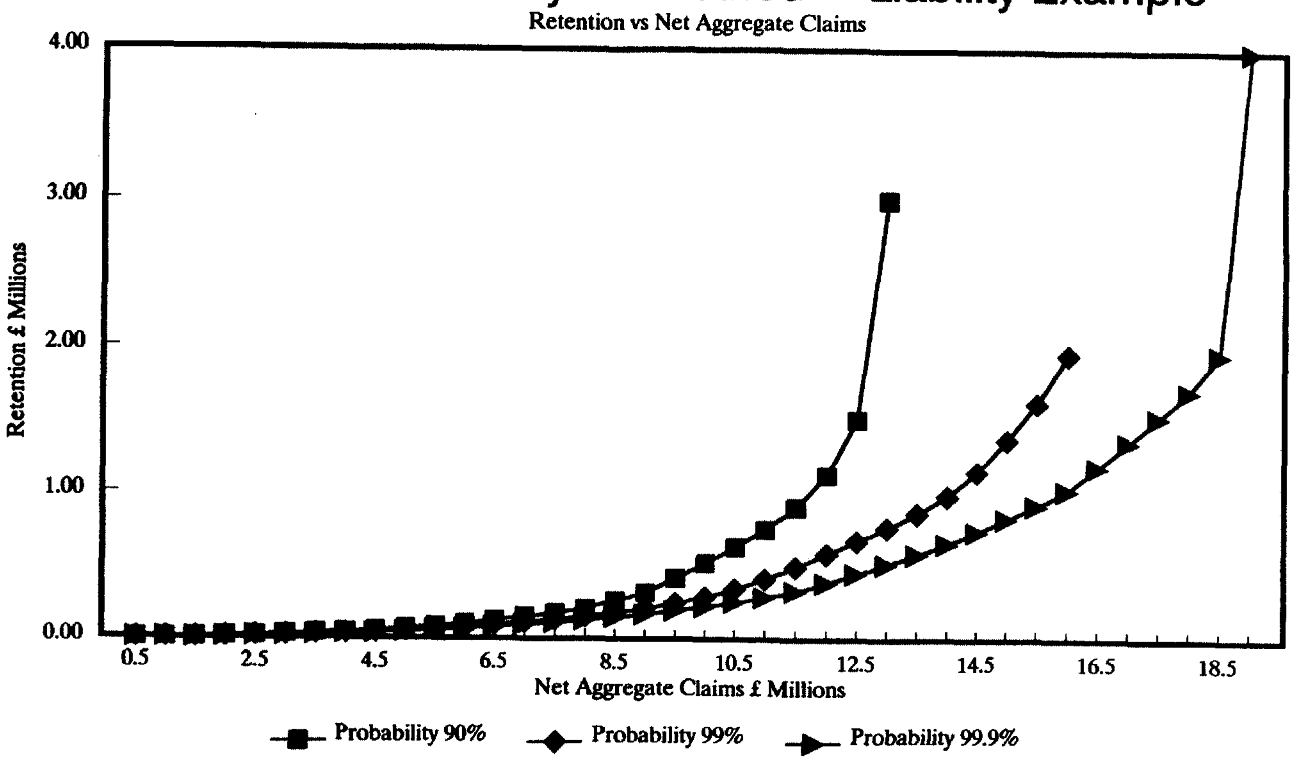
Retention	Capital at Risk as a Percentage of Total Gross Premium 90%	99%	99.9%	Retention
Infinity	11.88	35.07	53.00	Infinity
2,000,000	11.06	33.02	50.82	14.00
1,500,000	9.77	29.43	44.61	10.50
1,000,000	8.01	24.31	37.09	7.00
500,000	4.04	15.07	24.65	3.50
250,000	1.87	10.40	16.64	1.75
100,000	0.45	5.06	8.68	0.70
50,000	(0.61)	2.23	4.39	0.35

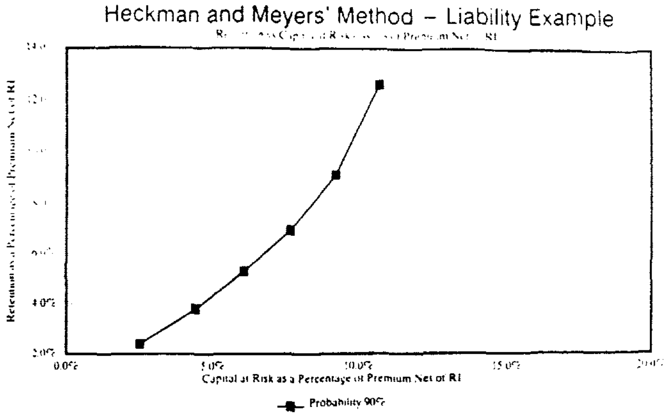
Retention	Capital at Risk as a Percentage of Net Premium 90%	99%	99.9%	Retention
Infinity	11.88	35.07	53.00	Infinity
2,000,000	11.16	33.29	51.25	14.12
1,500,000	10.07	30.35	46.00	10.83
1,000,000	8.61	26.14	39.87	7.53
500,000	4.94	18.43	30.16	4.28
250,000	2.64	14.65	23.43	2.46
100,000	0.87	9.80	16.80	1.36
50,000	(1.56)	5.71	11.23	0.90

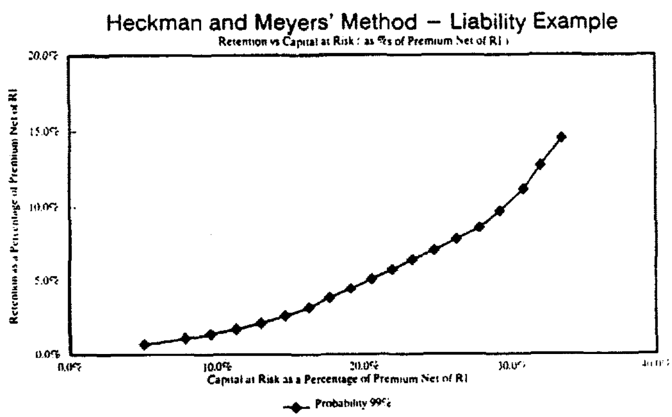
Total Gross Premium = 14,285,714
Total Loading in Premiums = 30%
Expense Element of Premium = 20%

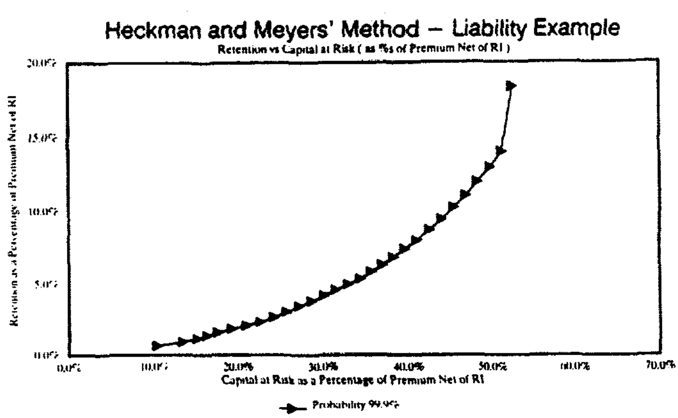
Capital at Risk = Net Aggregate Claims - Premium Net of Reinsurance and Expenses

Heckman and Meyers' Method – Liability Example




Heckman and Meyers' Method – Liability Example
0.0%
5.0%
10.0%
15.0%
Capital at Risk as a Percentage of Premium Net of RI
Probability 90%


Heckman and Meyers' Method – Liability Example
Retention vs Capital at Risk (as %s of Premium Net of RI)
20.0%
15.0%
10.0%
5.0%
0.0%
10.0%
20.0%
30.0%
Retention as a Percentage of Premium Net of RI
Capital at Risk as a Percentage of Premium Net of RI
Probability 99%


Heckman and Meyers' Method – Liability Example
Retention vs Capital at Risk (as %s of Premium Net of RI)
20.0%
15.0%
10.0%
5.0%
0.0%
10.0%
20.0%
30.0%
40.0%
50.0%
60.0%
70.0%
Retention as a Percentage of Premium Net of RI
Capital at Risk as a Percentage of Premium Net of RI
Probability 99.9%

Heckman and Meyers' Method - Property Example
Aggregate Claims Distribution

Aggregate Mean	Claim Severity Distribution	Contagion Parameter	Claim Freq. Mean	Claim Freq. Std Dev	
40,383,860		0.0000	13,661.000	116.960	

Mixing Parameter	Aggregate Mean	Aggregate Std Dev	H	Number Of Intervals	Est Trunc Er In EPP Ratio
0.00%	40,383,860	6,858,151	0.6100	24	0.000002

Aggregate Claim Amount	Entry Ratio	Cumulative Probability	Excess Pure Premium	Excess Pure Premium Ratio
28,268,702	0.70000	1.83%	12,138,070	30.1%
32,307,088	0.80000	11.01%	8,325,236	20.6%
36,345,474	0.90000	29.98%	5,086,805	12.6%
40,383,860	1.00000	53.49%	2,732,753	6.8%
44,422,246	1.10000	73.94%	1,287,311	3.2%
44,826,085	1.11000	75.62%	1,185,492	2.9%
45,229,923	1.12000	77.24%	1,090,339	2.7%
45,633,762	1.13000	78.78%	1,001,556	2.5%
46,037,600	1.14000	80.25%	918,847	2.3%
46,441,439	1.15000	81.64%	841,917	2.1%
48,460,632	1.20000	87.55%	533,773	1.3%
48,864,471	1.21000	88.53%	485,497	1.2%
49,268,309	1.22000	89.45%	441,057	1.1%
49,672,148	1.23000	90.31%	400,209	1.0%
50,075,986	1.24000	91.11%	362,716	0.9%
50,479,825	1.25000	91.86%	328,350	0.8%
50,883,664	1.26000	92.55%	296,896	0.7%
51,287,502	1.27000	93.20%	268,144	0.7%
51,691,341	1.28000	93.80%	241,899	0.6%
52,095,179	1.29000	94.35%	217,975	0.5%
52,499,018	1.30000	94.86%	196,194	0.5%
52,902,857	1.31000	95.33%	176,392	0.4%
53,306,695	1.32000	95.76%	158,411	0.4%
53,710,534	1.33000	96.16%	142,106	0.4%
54,114,372	1.34000	96.52%	127,340	0.3%
54,518,211	1.35000	96.86%	113,985	0.3%
56,537,404	1.40000	98.14%	64,467	0.2%
60,575,790	1.50000	99.40%	19,121	0.1%
64,614,176	1.60000	99.83%	5,193	0.0%
68,652,562	1.70000	99.96%	1,340	0.0%
70,671,755	1.75000	99.98%	691	0.0%

Heckman and Meyers' Method - Property Example

Retention	Net Aggregate Claims 90%	Net Aggregate Claims 99%	Net Aggregate Claims 99.9%	Net Aggregate Claims Mean	Reinsurance Risk Premium	Reinsurance Premium Net of Expenses	Premium Net of Reinsurance and Expenses
Infinity	49,819,650	59,303,860	67,099,340	40,383,860	0	0	46,152,987
1,000,000	36,041,260	39,664,130	42,220,870	32,339,390	8,044,470	9,193,680	36,959,307
500,000	32,466,640	34,852,050	36,703,350	29,779,590	10,604,270	12,119,166	34,033,821
250,000	28,937,770	30,639,720	31,943,310	26,979,140	13,404,720	15,319,680	30,833,307
200,000	27,733,100	29,247,760	30,362,690	25,978,770	14,405,090	16,462,960	29,690,027
150,000	26,160,000	27,462,100	28,426,640	24,647,370	15,736,490	17,984,560	28,168,427
100,000	23,881,340	24,905,960	25,678,690	22,667,190	17,716,670	20,247,623	25,905,364
50,000	20,524,950	21,237,130	21,790,610	19,660,700	20,723,160	23,683,611	22,469,376
10,000	12,782,330	13,056,330	13,277,990	12,439,930	27,943,930	31,935,920	14,217,067
5,000	9,987,180	10,173,110	10,320,780	9,765,680	30,618,180	34,992,206	11,160,781
2,500	7,550,660	7,666,410	7,765,550	7,408,590	32,975,270	37,686,023	8,466,964
1,000	4,935,690	4,998,530	5,047,590	4,859,290	35,524,570	40,599,509	5,553,478
500	3,420,490	3,459,020	3,489,060	3,373,200	37,010,660	42,297,897	3,855,090

Retention	Capital at Risk 90%	Capital at Risk 99%	Capital at Risk 99.9%
Infinity	3,666,663	13,150,873	20,946,353
1,000,000	(918,047)	2,704,823	5,261,563
500,000	(1,567,181)	818,229	2,669,529
250,000	(1,895,537)	(193,587)	1,110,003
200,000	(1,956,927)	(442,267)	672,663
150,000	(2,008,427)	(706,327)	258,213
100,000	(2,024,024)	(999,404)	(226,674)
50,000	(1,944,426)	(1,232,246)	(678,766)
10,000	(1,434,737)	(1,160,737)	(939,077)
5,000	(1,173,601)	(987,671)	(840,001)
2,500	(916,304)	(800,554)	(701,414)
1,000	(617,788)	(554,948)	(505,888)
500	(434,600)	(396,070)	(366,030)

Retention	Capital at Risk as a Percentage of Total Gross Premium 90%	99%	99.9%	Retention
Infinity	6.36	22.80	36.31	Infinity
1,000,000	(1.59)	4.69	9.12	1.73
500,000	(2.72)	1.42	4.63	0.87
250,000	(3.29)	(0.34)	1.92	0.43
200,000	(3.39)	(0.77)	1.17	0.35
150,000	(3.48)	(1.22)	0.45	0.26
100,000	(3.51)	(1.73)	(0.39)	0.17
50,000	(3.37)	(2.14)	(1.18)	0.09
10,000	(2.49)	(2.01)	(1.63)	0.02
5,000	(2.03)	(1.71)	(1.46)	0.01
2,500	(1.59)	(1.39)	(1.22)	0.00
1,000	(1.07)	(0.96)	(0.88)	0.00

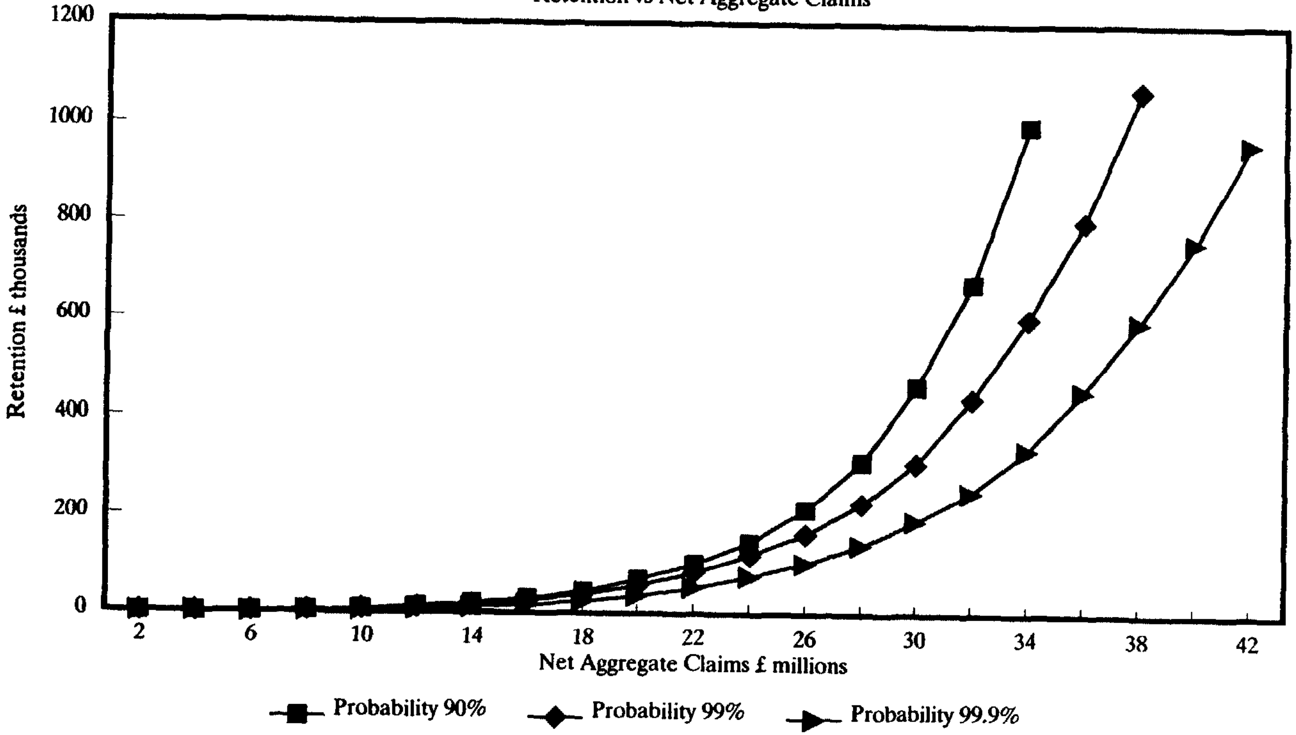
Retention	Capital at Risk as a Percentage of Net Premium 90%	99%	99.9%	Retention
Infinity	7.94	28.49	45.38	Infinity
1,000,000	(2.48)	7.32	14.24	2.71
500,000	(4.60)	2.40	7.84	1.47
250,000	(6.15)	(0.63)	3.60	0.81
200,000	(6.59)	(1.49)	2.27	0.67
150,000	(7.13)	(2.51)	0.92	0.53
100,000	(7.81)	(3.86)	(0.88)	0.39
50,000	(8.65)	(5.48)	(3.02)	0.22
10,000	(10.09)	(8.16)	(6.61)	0.07
5,000	(10.52)	(8.85)	(7.53)	0.04
2,500	(10.82)	(9.46)	(8.28)	0.03
1,000	(11.12)	(9.99)	(9.11)	0.02
500	(11.27)	(10.27)	(9.49)	0.01

Total Gross Premium = 57,691,234
Total Loading in Premiums = 30%
Expense Element of Premium = 20%

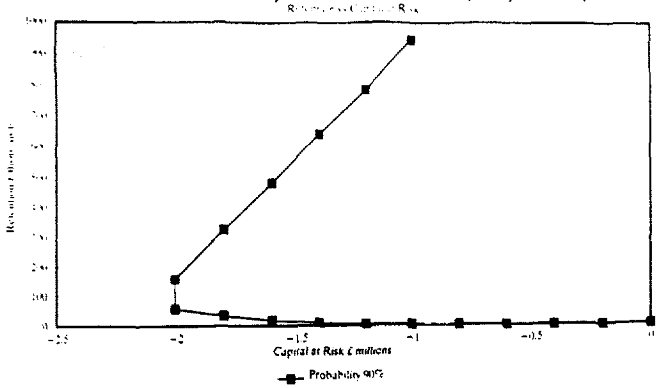
Capital at Risk = Net Aggregate Claims - Premium Net of Reinsurance and Expenses

Heckman and Meyers' Method – Property Example

Retention vs Net Aggregate Claims

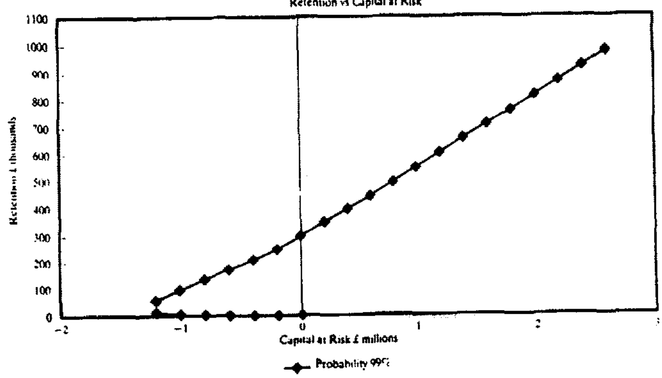


Heckman and Meyers' Method – Property Example



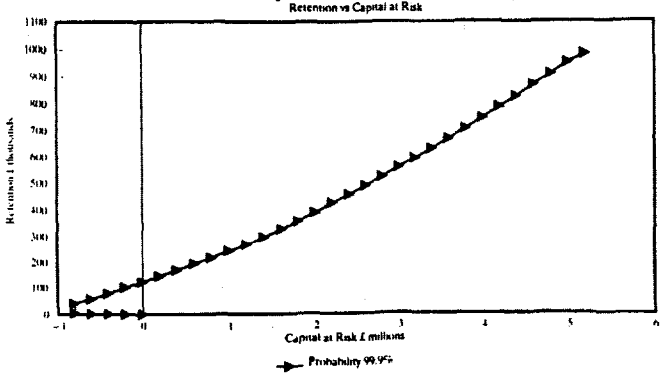
Heckman and Meyers' Method – Property Example

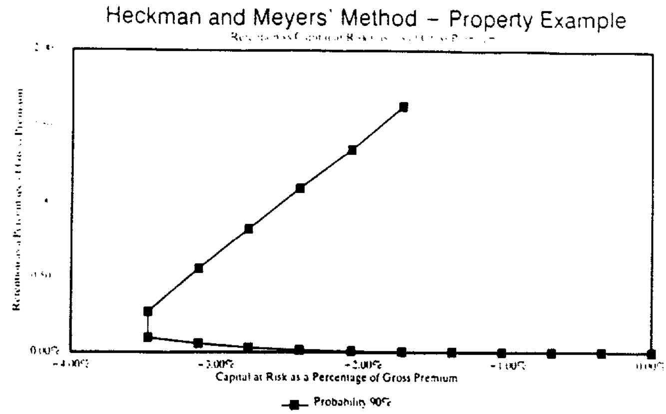
Retention vs Capital at Risk

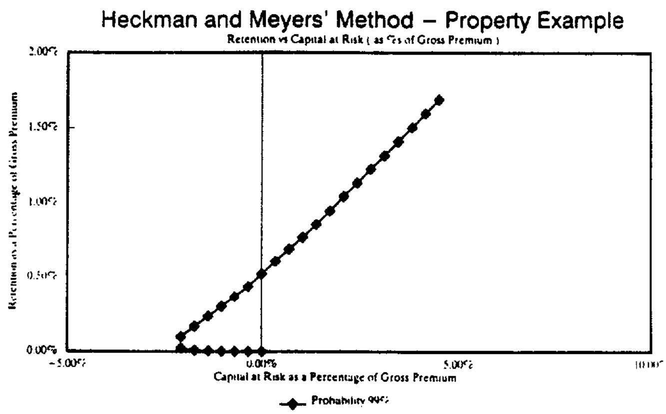


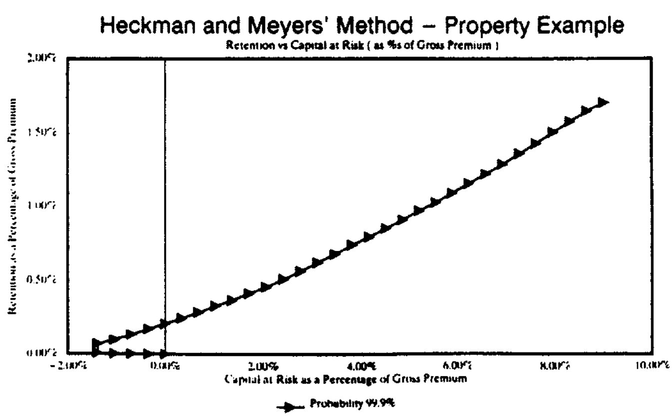
Heckman and Meyers' Method – Property Example

Retention vs Capital at Risk

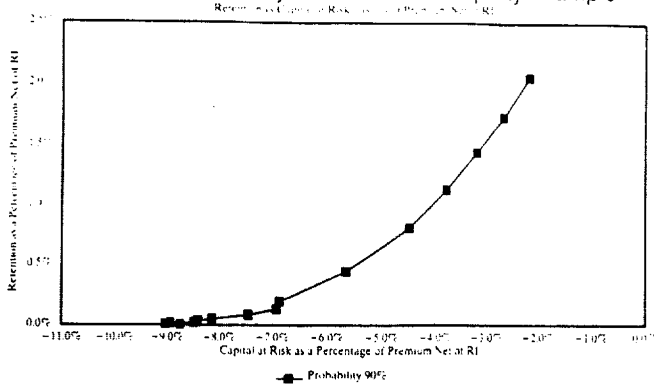



Heckman and Meyers' Method - Property Example
Capital at Risk as a Percentage of Gross Premium
Probability 90%

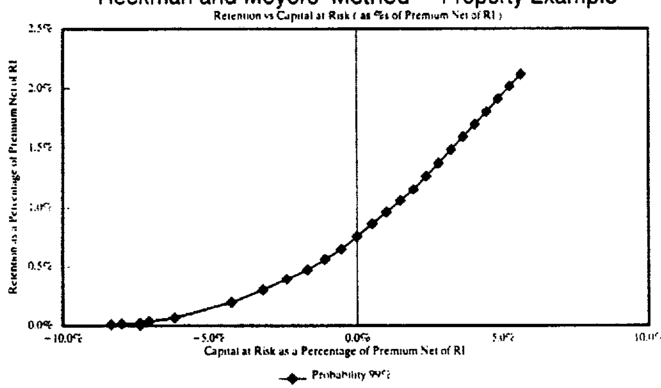

Heckman and Meyers' Method - Property Example
Retention vs Capital at Risk (as % of Gross Premium)
2.00%
1.50%
1.00%
0.50%
0.00%
-5.00%
0.00%
5.00%
Capital at Risk as a Percentage of Gross Premium
Probability 99%


Heckman and Meyers' Method - Property Example
Retention vs Capital at Risk (as %s of Gross Premium)
2.00%
0.00%
2.00%
4.00%
6.00%
8.00%
10.00%
Capital at Risk as a Percentage of Gross Premium
Probability 99.9%

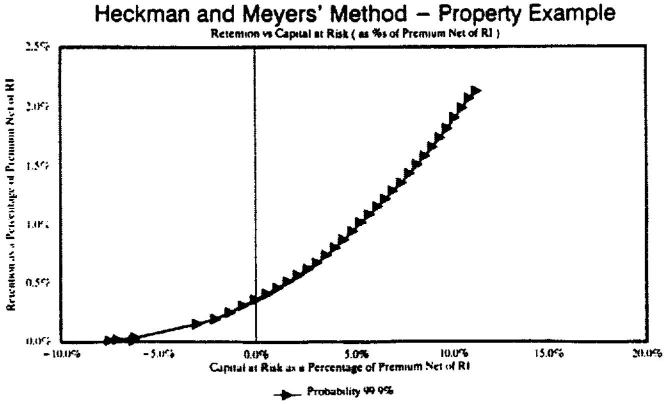
Heckman and Meyers' Method – Property Example



Heckman and Meyers' Method – Property Example



Heckman and Meyers' Method – Property Example



UK Property Catastrophes
Past Claims in excess of £40 million original cost
Amounts in £ millions

Date of Claim	Original Cost	Adjusted to 1990 Values	Claims above £100 million
Jan 79	60	327	327
Dec 81	100	349	349
Dec 81	60	174	174
Jan 82	60	153	153
Jan 82	160	349	349
Jan 84	120	196	196
Jan 85	40	87	0
Jan 85	40	87	0
Feb 85	100	174	174
Dec 85	80	131	131
Mar 86	60	87	0
Jan 87	320	414	414
Oct 87	1,240	1,591	1,591
Jan 90	1,700	1,700	1,700
Feb 90	300	300	300
Average			488

UK Property Catastrophes
Simulation Results for Gross Aggregate Annual Claims Cost
Number of Simulations 5000
Amounts in £ millions

	ESTIMATED COMPANY GROSS COSTS		
	Pareto 1.25	Pareto 1.33	Pareto 1.50
Poisson 0.75			
Average	27	25	21
SD	72	70	51
Poisson 1.00			
Average	37	33	28
SD	83	79	64
Poisson 1.25			
Average	45	42	34
SD	92	94	65

UK Property Catastrophes
Simulation Results for Gross Aggregate Annual Claims Cost
Number of Simulations 5000
Amounts in £ millions

ESTIMATED COMPANY GROSS COSTS

	Pareto 1.25	Pareto 1.33	Pareto 1.50
Poisson 0.75			
Average	27	25	21
SD	72	70	51
Poisson 1.00			
Average	37	33	28
SD	83	79	64
Poisson 1.25			
Average	45	42	34
SD	92	94	65

ESTIMATED COMPANY NET COSTS

	Pareto 1.25	Pareto 1.33	Pareto 1.50
Poisson 0.75			
Average	19	18	16
SD	50	51	36
Poisson 1.00			
Average	25	24	22
SD	58	57	46
Poisson 1.25			
Average	32	31	26
SD	65	68	46

Note : Reinsurance Per Event Catastrophe £170 XS £30 million

An Investigation of Catastrophe Reinsurance Smoothing

Fixed Reinsurance Cost – Frequency Parameter 0.75

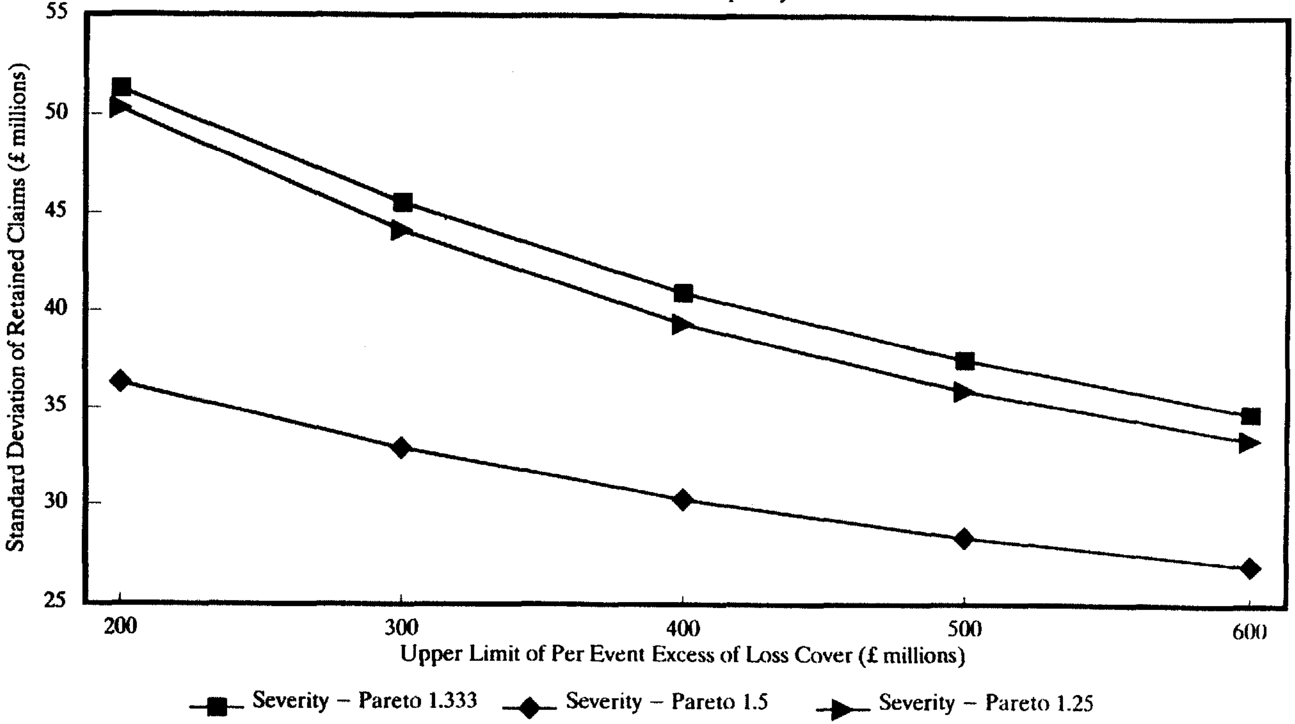


Exhibit 4
Page 4

An Investigation of Catastrophe Reinsurance Smoothing

Fixed Reinsurance Cost – Frequency Parameter 1

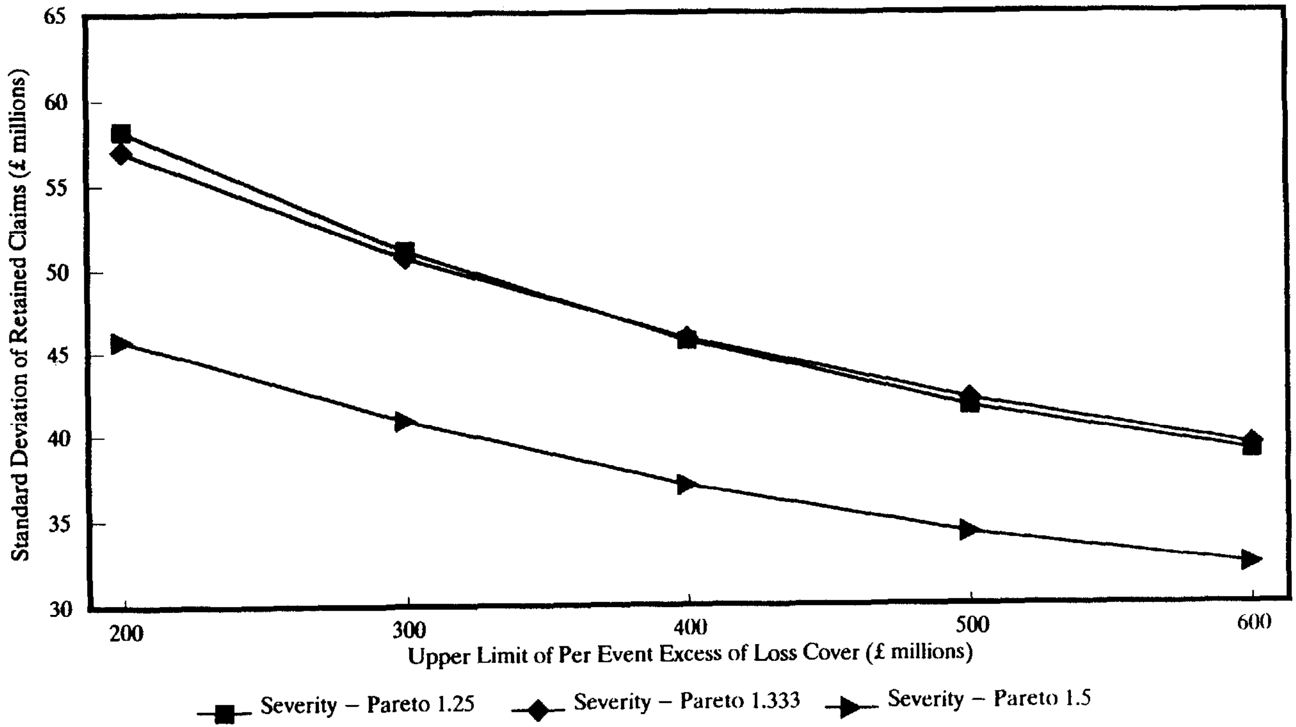


Exhibit 4
Page 5

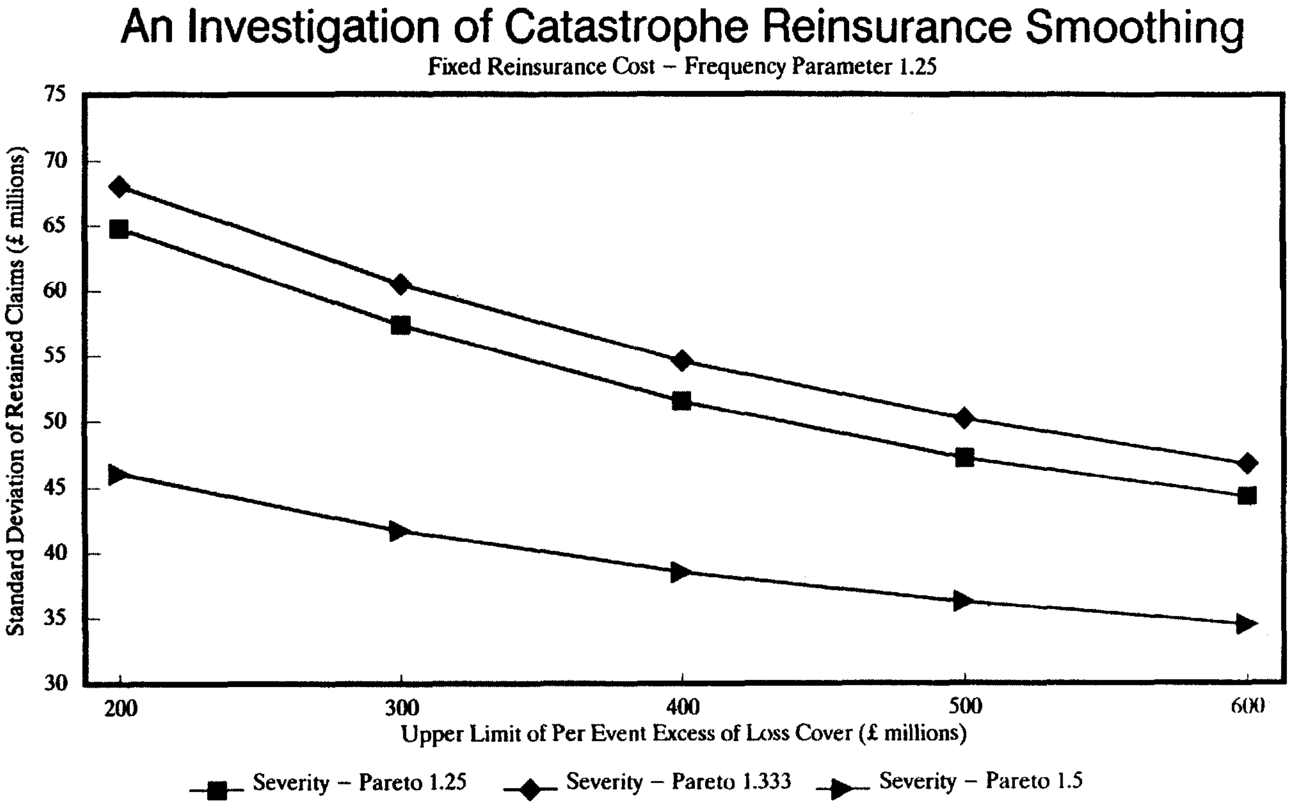


Exhibit 4
Page 6

An Investigation of Catastrophe Reinsurance Smoothing

Fixed Reinsurance Cost

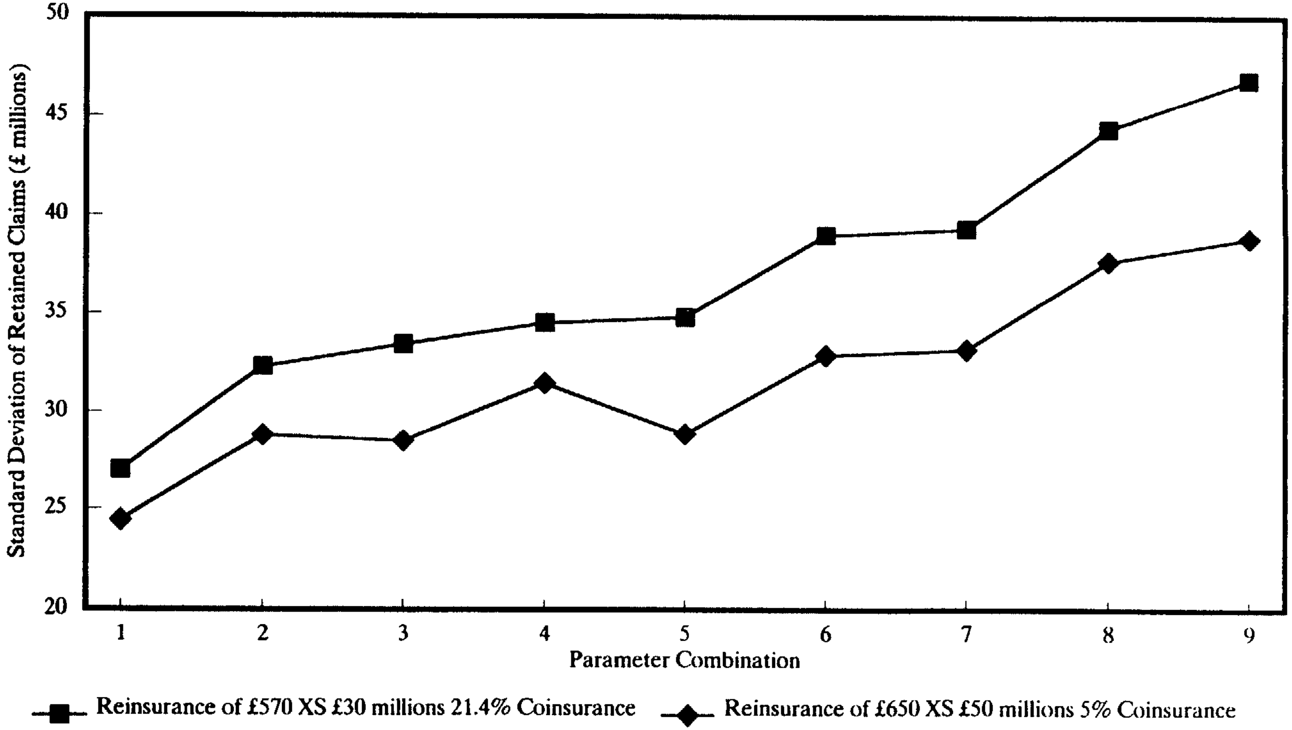
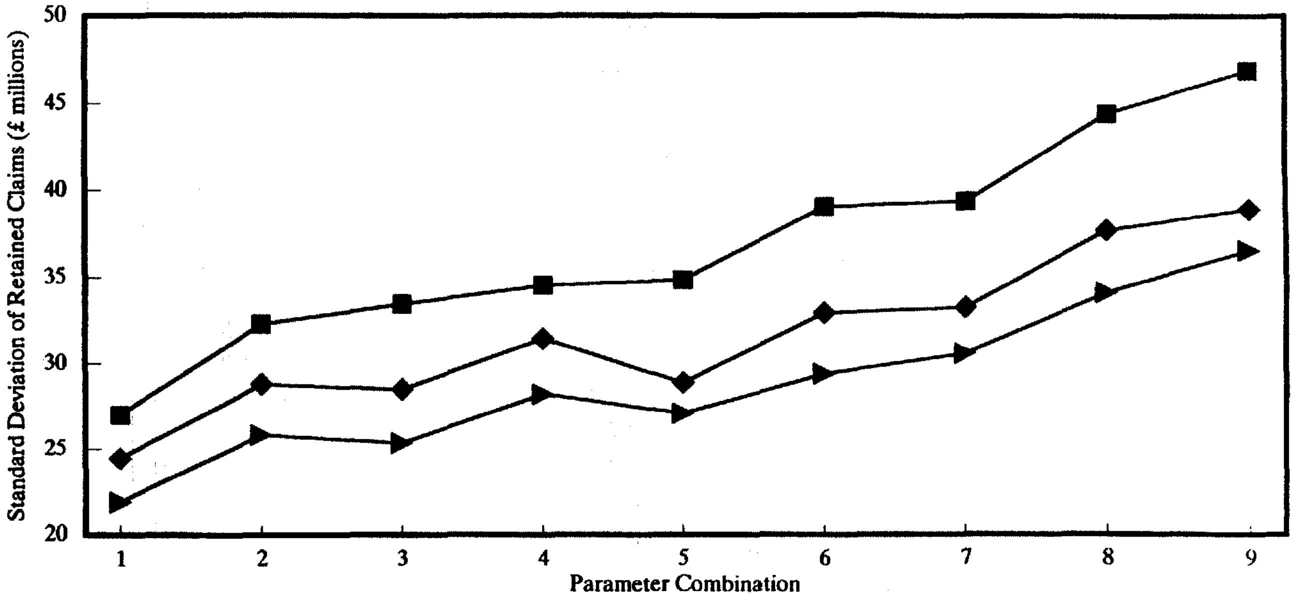


Exhibit 4
Page 7

An Investigation of Catastrophe Reinsurance Smoothing

Fixed Reinsurance Cost

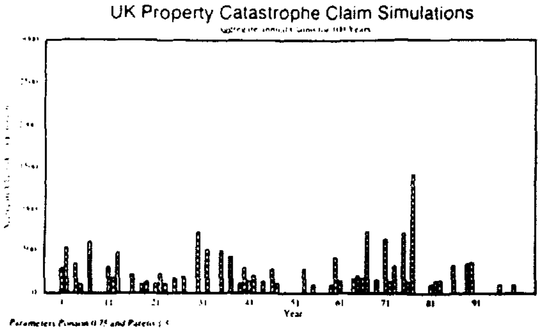


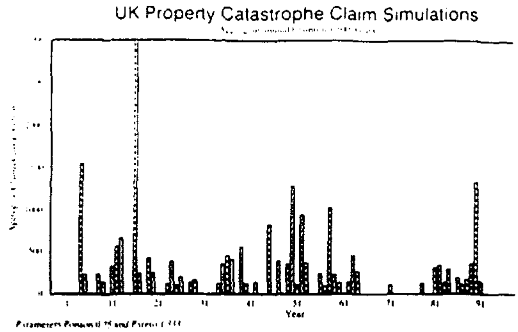
Reinsurance of £570 XS £30 millions 21.4% Coinsurance

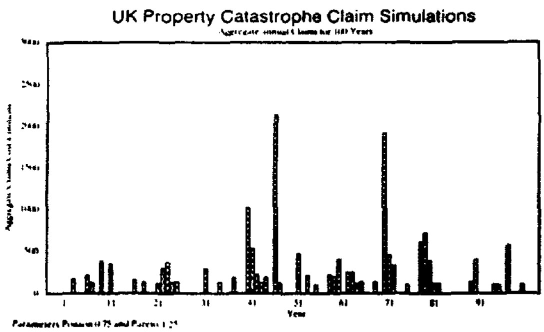
Reinsurance of £650 XS £50 millions 5% Coinsurance

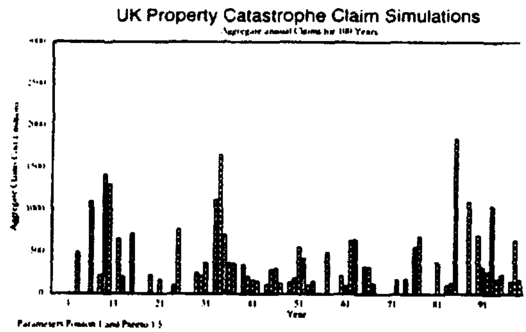
Stop Loss on Catastrophe Events £100 XS £50 millions

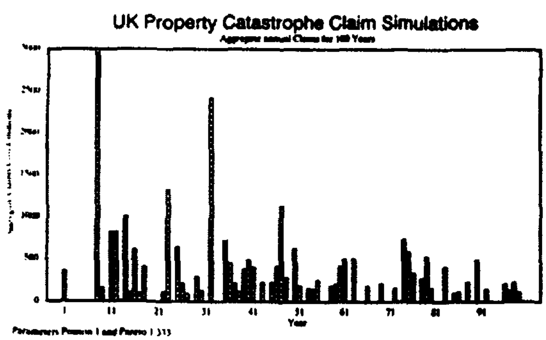
The cost of the stop loss cover is not known

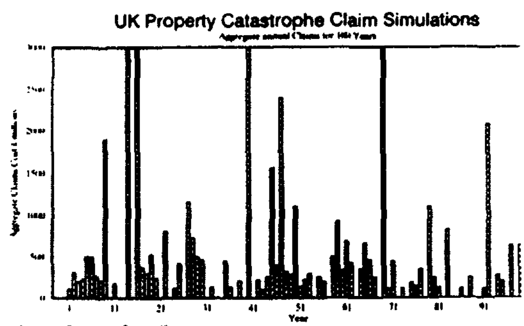

UK Property Catastrophe Claim Simulations
Year


UK Property Catastrophe Claim Simulations
Year

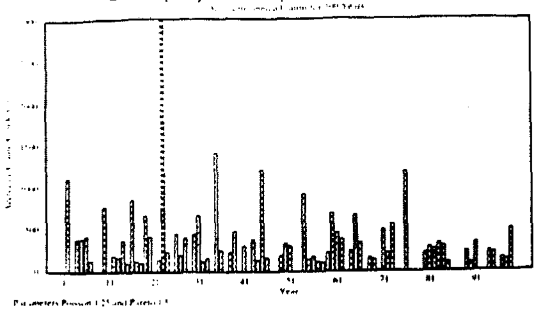

UK Property Catastrophe Claim Simulations
Year


UK Property Catastrophe Claim Simulations
Year

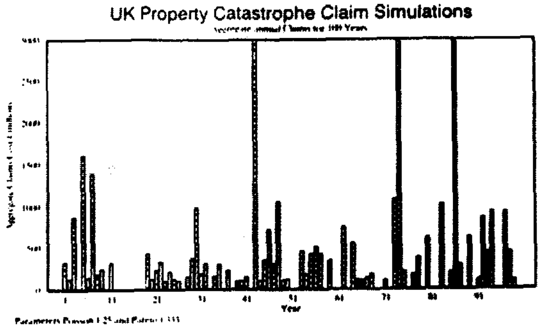

UK Property Catastrophe Claim Simulations
Year


UK Property Catastrophe Claim Simulations
Year

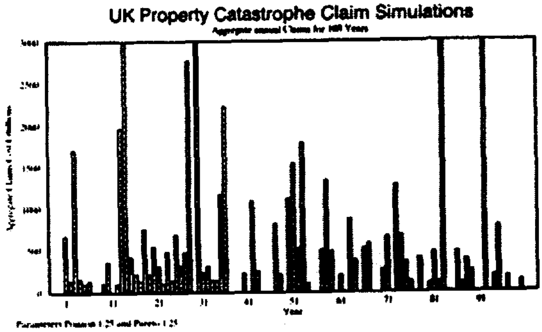
UK Property Catastrophe Claim Simulations



UK Property Catastrophe Claim Simulations



UK Property Catastrophe Claim Simulations



UK Property Catastrophes
Actual versus Central Limit Theorem Confidence Limits
Demonstration on Net of Reinsurance Distributions
Reinsurance - Per Event Catastrophe £570 XS £30 million

	<--------- Actual	--------->	<--------- One Tail Central Limit	--------->
	95% Confidence	99% Confidence	95% Confidence	99% Confidence
Poisson 0.75 Pareto 1.5	54.6	85.9	40.1	57.0
Poisson 0.75 Pareto 1.333	58.2	105.8	47.3	67.3
Poisson 0.75 Pareto 1.25	63.0	116.3	46.8	66.4
Poisson 1 Pareto 1.5	66.5	106.3	47.2	67.1
Poisson 1 Pareto 1.333	72.3	124.2	54.5	77.4
Poisson 1 Pareto 1.25	75.7	124.8	54.0	76.7
Poisson 1.25 Pareto 1.5	73.2	114.7	51.6	73.3
Poisson 1.25 Pareto 1.333	85.1	146.6	63.7	90.5
Poisson 1.25 Pareto 1.25	87.6	145.9	61.8	87.7

Recursive Method - Aviation Example
Individual Claim Severity Distribution

No. of Data Points 40
Scaling Factor 1,500

Discretised Distribution of X	Frequency	Relative Frequency f(x)	Cumulative Frequency F(x)	x*f(x)	Col (5) Cumulative	x^2 * f(x)	Col (7) Cumulative
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
0	14	0.350	0.350	0.000	0.000	0.000	0.000
1	8	0.200	0.550	0.200	0.200	0.200	0.200
2	4	0.100	0.650	0.200	0.400	0.400	0.600
3	4	0.100	0.750	0.300	0.700	0.900	1.500
4	2	0.050	0.800	0.200	0.900	0.800	2.300
5	0	0.000	0.800	0.000	0.900	0.000	2.300
6	1	0.025	0.825	0.150	1.050	0.900	3.200
7	0	0.000	0.825	0.000	1.050	0.000	3.200
8	0	0.000	0.825	0.000	1.050	0.000	3.200
9	0	0.000	0.825	0.000	1.050	0.000	3.200
10	1	0.025	0.850	0.250	1.300	2.500	5.700
11	0	0.000	0.850	0.000	1.300	0.000	5.700
12	0	0.000	0.850	0.000	1.300	0.000	5.700
13	1	0.025	0.875	0.325	1.625	4.225	9.925
14	0	0.000	0.875	0.000	1.625	0.000	9.925
15	0	0.000	0.875	0.000	1.625	0.000	9.925
16	1	0.025	0.900	0.400	2.025	6.400	16.325
17	1	0.025	0.925	0.425	2.450	7.225	23.550
18	0	0.000	0.925	0.000	2.450	0.000	23.550
19	0	0.000	0.925	0.000	2.450	0.000	23.550
20	0	0.000	0.925	0.000	2.450	0.000	23.550
21	0	0.000	0.925	0.000	2.450	0.000	23.550
22	0	0.000	0.925	0.000	2.450	0.000	23.550
23	0	0.000	0.925	0.000	2.450	0.000	23.550
24	0	0.000	0.925	0.000	2.450	0.000	23.550
25	0	0.000	0.925	0.000	2.450	0.000	23.550
26	0	0.000	0.925	0.000	2.450	0.000	23.550
27	0	0.000	0.925	0.000	2.450	0.000	23.550
28	0	0.000	0.925	0.000	2.450	0.000	23.550
29	0	0.000	0.925	0.000	2.450	0.000	23.550
30	0	0.000	0.925	0.000	2.450	0.000	23.550
31	0	0.000	0.925	0.000	2.450	0.000	23.550
32	0	0.000	0.925	0.000	2.450	0.000	23.550
33	1	0.025	0.950	0.825	3.275	27.225	50.775
34	0	0.000	0.950	0.000	3.275	0.000	50.775
35	1	0.025	0.975	0.875	4.150	30.625	81.400
36+	1	0.025	1.000	0.900	5.050	32.400	113.800
Total		1.000		5.050		113.800	

Recursive Method - Liability Example
Individual Claim Severity Distribution

No. of Data Points 638
Scaling Factor 10,000

Discretised Distribution of X	Frequency	Relative Frequency f(x)	Cumulative Frequency F(x)	x*f(x)	Col (5) Cumulative	x^2 * f(x)	Col (7) Cumulative
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
0	268	0.4201	0.4201	0.0000	0.0000	0.0000	0.0000
1	161	0.2524	0.6724	0.2524	0.2524	0.2524	0.2524
2	63	0.0987	0.7712	0.1975	0.4498	0.3950	0.6473
3	41	0.0643	0.8354	0.1928	0.6426	0.5784	1.2257
4	20	0.0313	0.8668	0.1254	0.7680	0.5016	1.7273
5	8	0.0125	0.8793	0.0627	0.8307	0.3135	2.0408
6	11	0.0172	0.8966	0.1034	0.9342	0.6207	2.6614
7	7	0.0110	0.9075	0.0768	1.0110	0.5376	3.1991
8	4	0.0063	0.9138	0.0502	1.0611	0.4013	3.6003
9	7	0.0110	0.9248	0.0987	1.1599	0.8887	4.4890
10	4	0.0063	0.9310	0.0627	1.2226	0.6270	5.1160
11	2	0.0031	0.9342	0.0345	1.2571	0.3793	5.4953
12	2	0.0031	0.9373	0.0376	1.2947	0.4514	5.9467
13	2	0.0031	0.9404	0.0408	1.3354	0.5298	6.4765
14	4	0.0063	0.9467	0.0878	1.4232	1.2288	7.7053
15	0	0.0000	0.9467	0.0000	1.4232	0.0000	7.7053
16	3	0.0047	0.9514	0.0752	1.4984	1.2038	8.9091
17	2	0.0031	0.9545	0.0533	1.5517	0.9060	9.8150
18	1	0.0016	0.9561	0.0282	1.5799	0.5078	10.3229
19	0	0.0000	0.9561	0.0000	1.5799	0.0000	10.3229
20	4	0.0063	0.9624	0.1254	1.7053	2.5078	12.8307
21	3	0.0047	0.9671	0.0987	1.8041	2.0737	14.9044
22	0	0.0000	0.9671	0.0000	1.8041	0.0000	14.9044
23	2	0.0031	0.9702	0.0721	1.8762	1.6583	16.5627
24	1	0.0016	0.9718	0.0376	1.9138	0.9028	17.4655
25	2	0.0031	0.9749	0.0784	1.9922	1.9592	19.4248
26	0	0.0000	0.9749	0.0000	1.9922	0.0000	19.4248
27	2	0.0031	0.9781	0.0846	2.0768	2.2853	21.7100
28	1	0.0016	0.9796	0.0439	2.1207	1.2288	22.9389
29	1	0.0016	0.9812	0.0455	2.1661	1.3182	24.2571
30	1	0.0016	0.9828	0.0470	2.2132	1.4107	25.6677
31	0	0.0000	0.9828	0.0000	2.2132	0.0000	25.6677
32	0	0.0000	0.9828	0.0000	2.2132	0.0000	25.6677
33	0	0.0000	0.9828	0.0000	2.2132	0.0000	25.6677
34	0	0.0000	0.9828	0.0000	2.2132	0.0000	25.6677
35	0	0.0000	0.9828	0.0000	2.2132	0.0000	25.6677
36	0	0.0000	0.9828	0.0000	2.2132	0.0000	25.6677
37	0	0.0000	0.9828	0.0000	2.2132	0.0000	25.6677
38	1	0.0016	0.9843	0.0596	2.2727	2.2633	27.9310
39	3	0.0047	0.9890	0.1834	2.4561	7.1520	35.0831
40	0	0.0000	0.9890	0.0000	2.4561	0.0000	35.0831
41+	7	0.0110	1.0000	0.4498	2.9060	18.4436	53.5266
Total		1.0000		2.9060		53.5266	

Recursive Method – Aviation Example

Retention vs Net Aggregate Claims

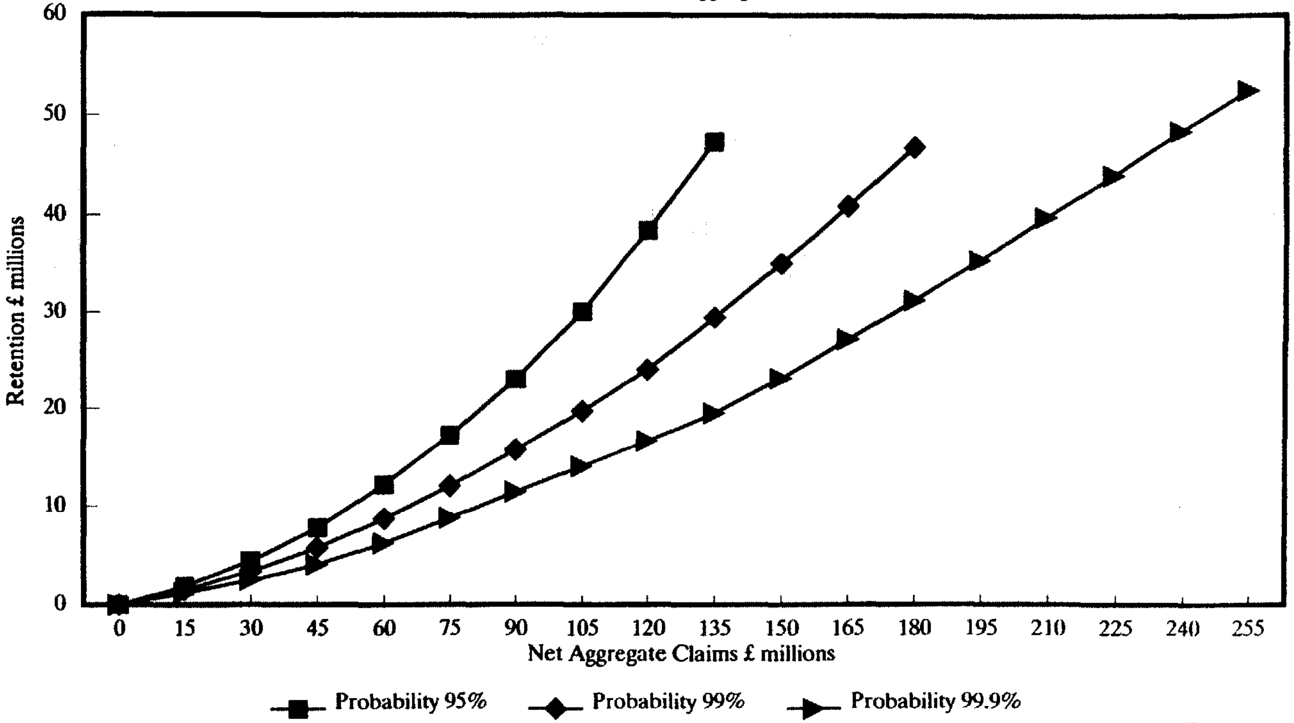
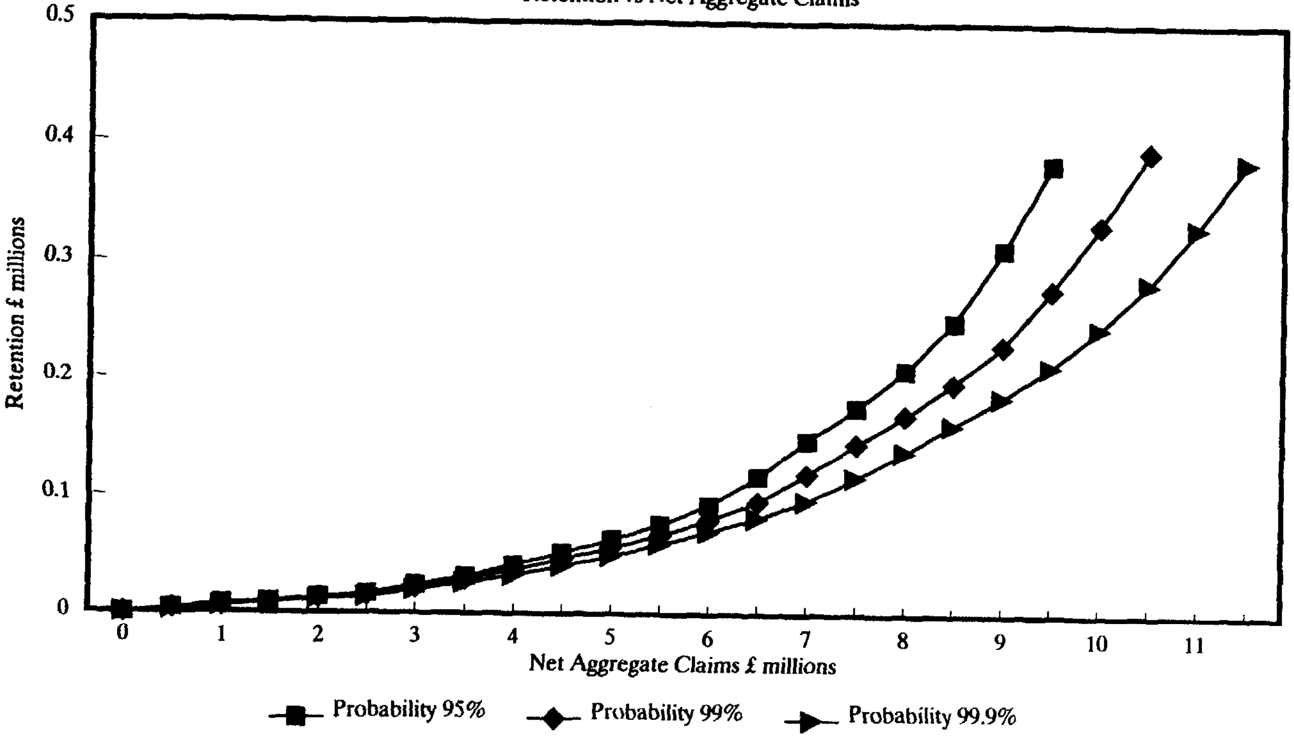
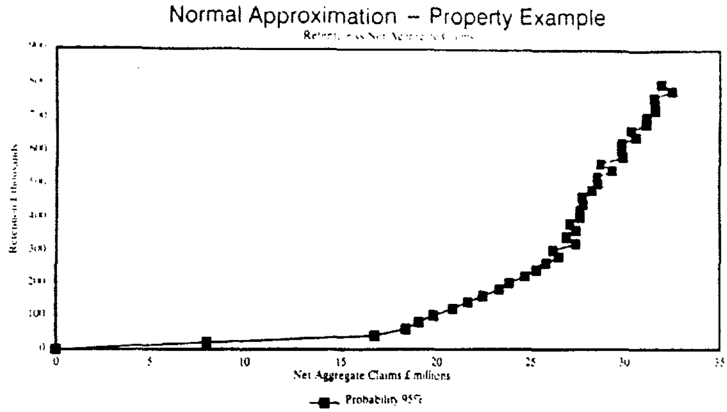


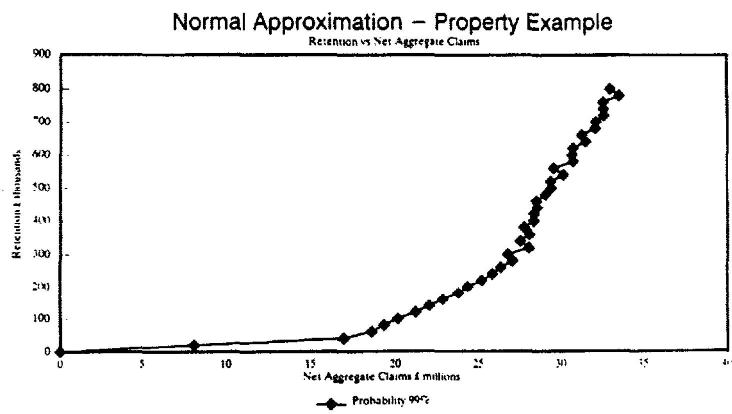
Exhibit 5
Page 3

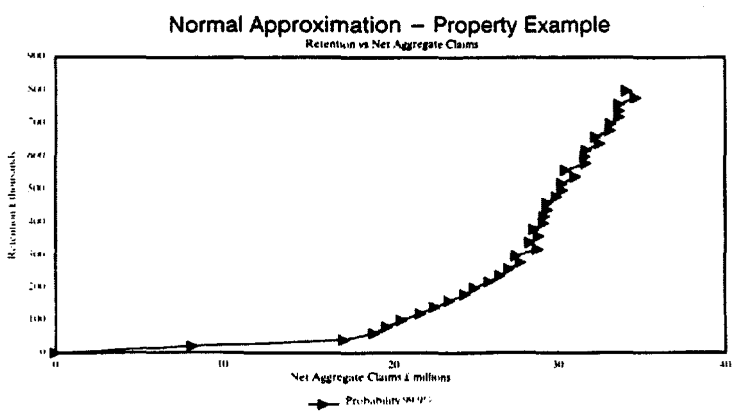
Recursive Method – Liability Example

Retention vs Net Aggregate Claims




Normal Approximation – Property Example
0
100
200
300
400
0
5
10
15
20
30
Net Aggregate Claims £ millions


Normal Approximation – Property Example
Retention vs Net Aggregate Claims
900
800
500
300
100
0
Retention £ thousands
0
5
10
15
20
30
Net Aggregate Claims £ millions


Normal Approximation – Property Example
Retention vs Net Aggregate Claims
10
20
30
Net Aggregate Claims £ millions