

The question of security is also examined. An important aspect of any method of pension scheme finance is the security offered to members in the event of the supporting employer's collapse. External funding has obvious merits in this respect, but, after all, in West Germany and France companies do go out of business without leaving the employee empty-handed in retirement. The paper examines how this is achieved.

The paper begins with an overview of pension provision, considering general economic and demographic factors. For example, one well-known argument against the pay-as-you-go system is that it becomes more expensive with an ageing population, but it is pointed out that demographic movements must have significant consequences for *any* system of financing in view of the underlying reliance of all pensioners on current production. This is shown to be true even with a system of externally funded schemes. In such a system the calls on the private sector, through equity dividends, and on the taxpayer, through government stock payments, would have to be spread over a reduced working population.

In the closing section of the paper the operation of a book reserve is considered and the authors examine some novel problems that arise in this area. In particular they consider how one may determine the interest addition to the book reserve, and the consequences for the actuarial valuation. It is pointed out that the close relationship between salary increases and interest rates traditionally looked for in pension funds may break down. Furthermore, whilst the concept of valuation surplus or deficit is useful to maintain a stable contribution rate for pension funds there are technical difficulties in applying this approach to book reserves.

Other topics considered include the question of pensions and company accounts (important because of the possible effect on financing methods), and legislative requirements in the U.K.

AVIATION INSURANCE

by

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(Synopsis of a paper presented to the Society on 3 February 1981)

THE paper investigates the feasibility of using the techniques of

probability and simulation to determine guide rates for aviation insurance. The various classes of aviation business considered are as follows:

(i) *Hulls*

Worldwide experience has shown that markedly different loss rates are applicable to different aircraft. The premium rate for a fleet of aircraft will be based on:

- (a) specification of the fleet: the number of each type of aircraft
- (b) underlying loss rates
- (c) value of each aircraft

In practice the rate charged will also be affected by the operator's experience and the area of operation. Cover for partial losses would be determined by applying a loading factor of around 100/70 to 100/50 of the premium for total losses.

(ii) *Passenger Liability*

The assessment of the premium for this class of business is seriously hampered by the difficulty in estimating settlement levels. Liability may be subject to Warsaw conventions or be unlimited as in America. The major problem is that of secrecy as insurance companies are unwilling to divulge out-of-court settlements.

(iii) *Product Liability*

This covers manufacturers against product failures and requires detailed understanding of the products' technical aspects.

Thus, for rating purposes only hulls business can be considered amenable to statistical analysis with the data currently available. The paper analyses numbers of total losses and rates of total loss by aircraft year for jet aircraft with the aim of determining hull premium rates.

Loss Rates for Jet Aircraft

The number of jet aircraft in commercial service has increased

rapidly since their introduction in 1958, accompanied by steady improvements in reliability, as the following table shows:

Table 1. *All Jet Aircraft*

| <i>Average loss rate</i> | <i>Year</i> | <i>Aircraft in service</i> |
|--------------------------|-------------|----------------------------|
| ·01 | 1963 | 798 |
| ·0075 | 1967 | 1,917 |
| ·005 | 1973 | 4,306 |
| ·004 | 1976 | 5,026 |
| ·003 | 1980 | n/k |

Examination of the pattern of loss rate levels of different aircraft are considered and used to find the underlying loss rates of the main types of jet aircraft. These are shown in the following table:

Table 2.

| <i>Aircraft</i> | <i>Underlying loss rate</i> |
|------------------|-----------------------------|
| Boeing 707/720 | ·006 |
| Boeing 727 | ·002 |
| Boeing 737 | ·003 |
| Boeing 747 | ·003 |
| Douglas DC8 | ·005 |
| Douglas DC9 | ·0025 |
| Douglas DC10 | ·005 |
| BAC 1-11 | ·006 |
| BAC VC10 | ·006 |
| Caravelle | ·006 |
| Corvaair 880/990 | ·01 |
| Fokker F.28 | ·014 |
| H.S. Trident | ·005 |
| Lockheed Tristar | ·002 |

Values of Aircraft

Aircraft are usually insured for replacement value in U.S. dollars. Table 3 in the paper shows ranges of values of the various models of the above aircraft.

Rating Examples

A small fleet is considered showing the calculation of the pure premium and standard deviation. The total premium would consist of the pure premium plus a loading to take account of the variance. For excess of loss rating a program has been developed using a

mini-computer to give the expected average excess claim amount and hence the risk premium for any particular retention. Two basic approaches have been used to model hull total loss business.

- (1) A random number generator is used to simulate the experience of a fleet of aircraft for a large number of years of experience.
- (2) Multinominals are used to obtain the exact distribution.

Conclusion

Considerable data are available on aircraft experience from such sources as Airclaims Service. This data can be used to determine guide rates for Fleet rating and excess of loss business although a lot more research is required particularly in the areas of partial losses and passenger liabilities for which additional data will be required.

Appendices

- (1) Tables of exposures, losses and loss rates
- (2) Graphs of loss rates by calendar year
- (3) Example of historical development of claims and settlements: DC10 crash near Paris in 1974
- (4) Table of fatalities for all jet aircraft.

SOME TRENDS IN INVESTMENT MARKETS

by

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(Synopsis of a paper presented to the Society on 31 March 1981)

THIS paper was originally presented to the Manchester Actuarial Society in December 1979. It was particularly appropriate at that time to look forward to a new decade. The three previous decades had shown that different factors can dominate the movements in interest rates and stockmarkets. In the 1950's assessment of the risks involved in equity investment resulted in ordinary shares showing higher yields than on fixed interest investments. The 1960's brought the reverse yield gap but in the 1970's it was the levels of and trends in interest rates which dominated movements in the ordinary share market.