JOIN THE DOTS AND MAKE A PICTURE

By A. S. Macdonald B.Sc., F.F.A.

1. INTRODUCTION

1.1 THE Guinness Book of Records once claimed that the number π to a million decimal places, printed in full and bound in book form, was the Most Boring Book in the World. To the uninitiated, the Department of Trade Returns of U.K. life offices must seem to be in the same class, and when I chose the topic I wondered if this might affect the welcome which this paper would receive. For anyone with a professional interest in life offices, however, the Returns are too important to ignore. They contain the greatest amount of published data on the U.K. life assurance industry, they form an essential prop of our liberal supervisory system and they ought to be a line of defence against tighter controls.

1.2 Life assurance has always been unusual in attracting long term contractual savings in large amounts. This was even more true a century ago than it is today, as there were no great pension funds or unit trusts. Human nature being what it is, this led some to view life assurance with more enthusiasm than sense. The mid-nineteenth century saw numerous small life offices set up, many of which were soon in trouble and it became common for such offices to be taken over by others. This was not so bad when the business was transferred to a larger, sounder office but quite often the new proprietor was an office in no better state than that taken over. It was by this means that the 'Albert' and the 'European' grew to large size, between them taking over 57 offices, most of which were insolvent. In 1869 both failed. The failure had been an actuarial certainty for years, but there was no requirement to publish any figures which would have revealed this, and both offices had been able to transact new business for long after they should have closed their doors. The immediate result was the Insurance Companies Act of 1870, which introduced the DOT returns (then called the Board of Trade Returns) to allow the public scrutiny which had been so sadly lacking in the cases of the 'Albert' and the 'European'.

Since life offices are complicated businesses not easily described by a simple balance sheet and revenue account it is hardly surprising that the Returns are complicated documents, outside the comprehension of most. It follows that there must be an expert official body responsible for interpreting the Returns, and this body is now the Department of Trade and Industry (hereafter abbreviated as 'DOT'), which has on hand the expertise of the Government Actuary's Department. For at least a century, the life assurance industry has been remarkably free of scandals and this must stem largely from the qualities of these watchdog bodies.

The same cannot be said of other financial sectors where looser regimes prevail (and where there is nothing to compare with the actuarial profession), a fact which should shortly be recognized by new legislation.

1.3 The principle upon which the supervision has been exercised is 'freedom with publicity'. This means, broadly, that offices can do what they like as long as it is public; then the DOT will know when to apply the brakes. The knowledge that the DOT may do so, perhaps also in public, will prevent the office from acting improperly or imprudently. Further, 'in public' means not merely furnishing data to the DOT as representatives of the public, but actually publishing such data so that anyone who wishes can satisfy himself that all is well. From this stemmed one of the basic requirements of the published data, that an independent actuary should be able to form an opinion as to the financial position of the office by studying the returns. This paper is largely concerned with the reasons for which independent actuaries might wish to do so and the problems they would face in the attempt.

2. THE INDEPENDENT ACTUARY

2.1 Think of an independent actuary who has just received a copy of a life office's DOT Returns with a request to report on the state of that office. For the moment we will ignore the purpose of the request; I wish at this stage to look at the steps he would take to extract the data and form his opinion. Since the Returns are supposed to let him carry out a full valuation we will assume that this is what he intends to do.

2.2 Start with the assets since in many ways this is the easy bit. In Form 13 of Schedule 1 there is an analysis of the market values of admissible assets held at the valuation date.

In Form 45 of Schedule 3 there is an analysis of the income expected in the next year from non-linked admissible assets, though in much broader classes than the analysis of admissible assets in Form 13. In Form 46 of Schedule 3 there is an analysis of admissible non-linked fixed interest securities by term, giving enough information to allow a consideration of matching. Using this, he can place a market value on the assets, or very crudely value a discounted flow of future income (for which Form 45 and 46 are both needed).

If he feels that it is justified, he can allocate certain of the fixed interest securities to certain of the liabilities (in particular, annuity business) and try to achieve a degree of matching. Beyond that, he can only examine the term and nature of the assets very broadly.

2.3 The liabilities are more complicated. In theory, all the data needed are in Schedule 5 and you simply choose your basis and apply it to that data. In practice there are problems.

    (i) Schedule 5 is not produced every year, it need only be published at least once every 5 years. Many changes can take place in 5 years; for example, in the past 5 years some offices have doubled, trebled or quadrupled in

size, others have entered the unit linked market or transacted huge amounts of new business of new types. This makes a nonsense of independent valuation in the years in between successive Schedule 5s. All that can be done is to try to update valuations carried out when Schedule 5 was last published, and this problem is considered further in Section 4.

(ii) Office premiums are given in Schedule 5 but there is no way of discovering net premiums on any basis. Your independent valuation must be a gross premium valuation, not a net premium valuation. While this is probably what is wanted anyway, it is a restriction of the actuary's freedom to choose his basis.

(iii) Data which really need two or more parameters for a complete description are usually only allowed one parameter. Thus endowments are given by year of maturity and there is no information on ages, whole life limited premiums are given either by year of expiry of premiums (requiring an estimated average age), or by additional valuation constants (which are even more obscure since they are a function of the office's valuation basis) and so on. Sometimes, there is an average age to which data apply but this too is a function of the office's valuation basis. Other classes which suffer from this are deferred annuities and pensions, joint life policies, joint life annuities and term assurances. The effect of this depends on how sensitive the policy values are to the 'averaged' parameter which must be assumed. Thus endowments can be valued quite well since their values are relatively more sensitive to term than to age, whereas term assurances or whole life limited premiums are very sensitive to the age which is assumed.

(iv) Group pension schemes come in many shapes and forms, and in valuing them one wants to know whether they are by regular or recurring single premiums, whether there are limited or indefinite premium guarantees, what is the form of profit sharing and so on. None of this information is in the Returns.

(v) Where policies have a cash or annuity option at maturity, the office lists either amounts of annuity or amounts of cash but not both. It chooses on the basis of which gives the greater liability, but this is a function of its own valuation basis. The opposite could be true under the actuary's independent basis but there is no way of finding out.

(vi) Data can be given in quinquennial age groups for many classes of policy, and in quinquennial term groups for endowments of terms over 15 years. This can lead to confusion, as shown in Section 4.11, because the policies need not be evenly spread over the ages and terms within the quinquennial groupings.

(vii) Quite significant amounts of business can be concealed within the 'Miscellaneous' category where only summary data needs to be given. At present this must not exceed 5% of the aggregate net liability but this makes it a function of the office's valuation basis, and does not allow for

the rapid expansion of a class of business in the years between successive Schedule 5s.

Every attempt will throw up individual problems, but this list will give an idea of the general problems in the way of the independent valuer.

2.4 Unit linked business complicates matters. In general reserves for unit linked contracts are split into unit reserves and non-unit reserves (covering maturity guarantees, surrenders, expenses, mortality and so on). Form 57 of Schedule 4 gives the number and type of units allocated, which can be compared with the total numbers and types of units held, shown in Form 47 and Form 50 of Schedule 3 though on an aggregate basis and not, unfortunately, for each contract. If the office operates a 'box' of units, these figures will disagree, but the amount of mismatching can be seen. Normally it will not matter because the 'box' will hold a margin over the units needed to match the contracts; a deficiency would be more interesting. If actuarial funding is in use this will be obvious because Form 75 of Schedule 5 ('unit liability partially or wholly discounted') will be used. Usually, therefore the unit reserves can be found directly, and having checked that penalties on surrender will always cover the missing capital units (and they should since they will normally be a percentage of capital units), the unit reserve becomes of trivial importance. Of course, it is possible to hold mismatched units, where the price is not related to the prices of the underlying assets, but this would be revealed by the balance sheets for each fund which are in Schedule 3, Form 49.

Non unit reserves are not so easy. The need for non unit reserves arises from any guarantees of mortality cover, maturity values or levels of expense loadings, so are dependant on the policy design. Policies are described in some detail in Schedule 4 but even so it is not always clear where the published non unit reserves arise or how to calculate reserves on the independent basis. Independent actuaries who get stuck at this point are in good company, as the GAD sometimes has the same problem. They, however, can and do ask companies for more information.

Some specific problems which I have encountered are given here.

(i) Endowment type policies may be listed by age only in Form 73 and have no data on term or future premium increases. While the information given allows the mortality reserve for the next year to be calculated, and also the charges which will be received in the next year, it does not allow the future course of reserves or need for capital to be examined, nor does it allow the effect of surrender penalties to be checked. This is a matter of some importance for anyone trying to place a value on the business, perhaps for purchase, rather than testing solvency.

(ii) Whole life contracts with maximum sums assured may effectively be term assurances with a sum assured guaranteed for up to ten years, and reviewed thereafter. There is no information on the imminence of a review or the likely outcome. This is significant because the investments may be

volatile and quite different from those underlying ordinary term assurances.

(iii) Where there are maturity guarantees (now uncommon in new policies) it is difficult to reserve at all. The Maturity Guarantees Working Party developed stochastic methods of reserving for these, but these require extensive data to be meaningful.

(iv) Much of the recent boom in life assurance has taken place on the unit linked side (at least up to March 1984). This makes the quinquennial interval between Schedule 5s much more important, as large new classes of business can be concealed for up to 5 years.

2.5 The above notes are nowhere near to being exhaustive, but they do illustrate that one ideal of the Returns, that of allowing an independent valuation, is incompletely realized in practice.

3. USERS OF THE RETURNS

3.1 The most important user of the DOT Returns is the DOT itself, with the help of the GAD. I found an air of mystery surrounding what the DOT actually *do* with the Returns—as far as established offices are concerned, the Returns are a bit of a chore and not many of them would expect their actuarial practices to be at fault in the eyes of the authorities. I am therefore very grateful to Mr T. W. Hewitson of the GAD for his explanations of the uses and limitations of the Returns in the work of the supervisors from which the following points are extracted.

(i) The DOT is checking more than solvency. In particular, they look for indications that a company might get into difficulties in the future, for example mismatching or high expenses in relation to premiums. They also keep an eye on the 'reasonable expectation of policyholders'.

(ii) There is great weight attached to the certificates appended to the Returns by the Actuary, directors and auditors. To the extent that the Returns do *not* allow double-checking, their accuracy and truth is a matter of professional responsibility.

(iii) Despite the extent of the data now supplied in the Returns, the DOT does often seek more information where that given is not clear, not sufficient, or does not allow the adequacy of the reserving basis to be examined. (For an independent actuary this is very significant since he is restricted to the data published.)

(iv) The DOT would not normally attempt a valuation based on Schedule 5 data. Rather, they use Schedule 5 to place a check on data in the other Returns and for a rough check on the matching of assets and liabilities by term.

(v) Many of the above points are particularly relevant when considering new unit linked offices.

3.2 Financial Analysts and Stockbrokers are interested in the relative share prices of proprietary life companies, and the wealth of detail in the Returns, even if not ideal for their purposes, is too great to ignore. There appear to be two approaches, depending on whether or not Schedule 5 data is to be used.

The first is outlined in (17), and requires the extraction of various ratios from Schedules 1, 3 and 4 but does not require a valuation so is of less interest to us here. The second is described in (11) and (12) and is based on the mutualization price of an office (i.e. the price that the policyholders would pay to buy out the shareholders), as a means of calculating the asset value. The importance of the DOT returns is very great in such an exercise and the problems outlined in Section 2 all manifest themselves, in particular, an old Schedule 5 may have to be updated by approximate methods. (In the discussion following (11), Mr P. J. Derby stated that he had actually used this method, updating Schedule 5 by means of crude approximations but he did not say what the methods of approximation were.) In addition to valuing the existing business, the value to the shareholders of future new business must be estimated. This is a purpose for which the Returns were never intended but they are of some use here in projecting trends, especially in conjunction with press comments, other published information and a little common sense. Any answers obtained from this kind of calculation are very crude and should be treated with caution.

Analysts studying the office from year to year would like to know the movements of business on and off, broken down by type of movement, type of policy, amount of benefit and amount of premium. These figures would reveal much about the 'quality' of the business. The Returns are notably unhelpful here, the tables in Schedule 3 being fairly general with the exception of the new business statement (Form 44).

Perhaps such emphasis on new business rests on an assumption that the 'ons' will always outweight the 'offs', which may be suited to the current climate but which may not hold in the long term. It does seem that any drain on capital caused by excessive new business may be spotted more easily than any unusual losses caused by early lapses.

3.3 Shareholders have an interest in the quality of management of the office and may wish to supplement the annual report with an expert interpretation of the DOT returns. I wonder how many shareholders (and policyholders too) know that the returns exist, or that they have a right to receive a copy on request.

3.4 Policyholders want to watch over their 'reasonable expectations', and may wish to look at the surplus generating power of the existing and new business. Their interests in this respect are similar to those of any shareholders (the latter's share of profits is usually a proportion of distributable surplus). In addition they may wish to know that their overall returns after terminal bonus are a fair return on their premiums.

Information for policyholders is often held up as one of the tests of 'freedom with publicity', but in practice I cannot imagine that policyholders would want the DOT returns, or know what to do with them. This appears to be one of those checks which is never used but whose value lies in simply being there.

3.5 Other life offices have a twofold interest. First, as competitors, they appreciate the data which is of a quality not afforded by competing concerns in other industries. This is one good reason for *not* extending the Returns in any way. Offices are more than competitors, however; they are also each others' guarantors through the Policyholder's Protection Act 1975. This rules that payments made to policyholders of a failed concern will be met by a levy on the premium income of other offices and leads to the prudent offices underwriting the imprudent.

Naturally, the offices may feel entitled to know something about the activities of each other not as competitors but as possible liabilities. To some extent, this usurps the function of the DOT itself, but the alternative of leaving the offices to pay while also leaving them in the dark is, perhaps, unpalatable. The PPA 1975 therefore gives a reason for maintaining and possibly improving the Returns. This question is not entirely academic; there have been levies made since 1975, though fortunately of relatively small amounts, and some offices are concerned enough by the implications of the Act to make provision in their policies for the deduction of levies from premiums.

3.6 In general, anyone with a commercial interest in a life office may find interesting material in the Returns. For a possible purchaser of a proprietary office, where the officials of the victim may be unwilling to co-operate or unaware of the threat, the Returns are vital. This is not a good reason for having them, however! Building societies whose mortgages are due to be repaid by endowment policies, or more pointedly by low cost endowment policies, have interests similar to those of policyholders, though they may have the influence to seek satisfaction directly with the offices in which they are interested.

3.7 Lastly and perhaps strangely, appointed Actuaries of life offices themselves may be thankful for the Returns. In the discussion of (6), two actuaries commented on the moral support given by a DOT requirement when faced by a non-actuarial and unco-operative management. This is unlikely to be a problem in Scotland, but it does hint at the difficulties which may be faced by actuaries working in less traditional offices.

4. JOINING THE DOTS

4.1 An independent valuation made in a year when Schedule 5 is not published must first treat the problem of out of date liability data. A method is needed of projecting forward what was last published, up to 5 years ago, allowing for new business, exits from all causes, intervening bonus declarations and so on.

4.2 The most obvious method is to update the individual tables or lists of data within Schedule 5 by applying data on movements each year. Straightaway we can dismiss this as no such data are available. The movement data in Schedule 3 are quite inadequate, and no comparable data are published. In fact, to be of any real use the data would have to be classified in the same way as that in Schedule 5.

4.3 There is no other way that I can imagine of projecting forward the actual

data from Schedule 5. Fortunately, the data is only a means to an end. What is really wanted is the value, on some basis, of the policies described by the data. This value can certainly be found in years when Schedule 5 is published, within limits discussed in Section 2, and it would be enough to project the *value* into future years, and to forget the raw data. This approach offers more hope because the values of each class of policy on the appointed Actuary's basis are published each year in Schedule 4, and it seems reasonable to seek a relationship between the values published from year to year in Schedule 4, and the values on our independent basis.

4.4 It may help to list here the useful figures published in Schedule 4 for each class of policy

(1) Amount of Sums Assured or Annuities per annum, including vested Reversionary Bonus.
(ii) Value of Sums Assured or Annuities per annum, including vested Reversionary Bonus.
(iii) Amount of Annual Office Premiums.
(iv) Value of Annual Office Premiums.
(v) Amount of Annual Net Premiums.
(vi) Value of Annual Net Premiums.
(vii) Amount of Net Liability.

Of these the most useful are (i) to (iv). The others are dependent on the office's valuation basis in too many ways, such as the amounts of the net premiums themselves, any zillmerisation employed and any limitations on net premiums to avoid negative values. The progression from year to year of the values of premiums involving these factors is distorted and not suitable for relating to the progression from year to year of the value of unadjusted office premiums.

4.5 The simplest approach can be described thus. Take a real or hypothetical portfolio of business in force in year 1, year 2 and so on. (This represents the data which would be published in Schedule 5.) Choose any two valuation bases, one to represent the appointed Actuary's basis in Schedule 4, the other to represent the independent Actuary's basis. Value the portfolios in each year and look for a relationship between the sequences of values on each basis.

4.6 I tried to find a function of successive values of benefits or premiums which would be constant no matter what the valuation basis. That is, a function $f(x, y)$ where x is a value of the benefits or premiums at time t and y is the value of the benefits or premiums at time $(t+1)$, both on the same valuation basis, such that the value of $f(x, y)$ does not depend, or at least depends in a known manner, on the valuation basis chosen. Given the information in Schedule 4 each year, this would allow the values on any chosen basis to be calculated from year to year using a valuation of the previous Schedule 5 as a starting point. Simple functions, such as $F(x, y) = x - y$, x/y, $\log x - \log y$, or $\log x/\log y$ were no use. Since premium values and benefit values are not themselves simple functions of the valuation basis this is no surprise.

4.7 The function which I eventually used was the difference in average ages. That is, where

$a(t)$ = amount of benefits or premiums at time t
$v(t)$ = value of benefits or premiums at time t

then $v(t)/a(t)$ gives an average value of A_x or $\ddot{a}_x$ at time t and the age x which gives this value of A_x or $\ddot{a}_x$ on the basis in use is the average age.

I found that the difference between average ages in successive years varied very little within a reasonable range of bases. This seems plausible since if one had to pick a single number to describe a portfolio of lives or policies, 'average age' would be an obvious choice.

4.8 Having found a function by using hypothetical portfolios, I put it to the test by trying it on some actual DOT Returns. I chose several sets of returns, the main requirement being that there should be a recently published Schedule 5. This would be the 'target', and by taking the previous Schedule 5 as a starting point and applying the above method, I could compare a projected Schedule 5 valuation with an actual Schedule 5 valuation.

4.9 The easiest way to describe the method in use is to give a detailed example. This is for the non profit endowment business of office X which published Schedule 5 every three years. The data thus refer to year 0, year 3 and year 6. The relevant figures from Schedule 4 for each of these years are as follows.

Table 1

	Year 0	Year 3	Year 6
Valuation interest rate	6·75%	4·25%	4·5%
Mortality table	A49/52	A67/70	A67/70
Amount of benefits	43548095	45207988	36989421
Value of benefits	14246452	22674765	20241226
Amount of office premiums	1262468	1287900	1078367
Value of office premiums	12501500	14452155	10263848

The basis for the independent valuation was chosen (arbitrarily) as A67/70 ult at 7% interest. In case anyone identifies office X, I must emphasize that there is no significance attached to this choice. The data in Schedule 5 were placed in a computer which valued benefits using $A_{x:\overline{n}|}$ and premiums using $\ddot{a}_{x:\overline{n}|}$. (These are not what one would normally use but as long as the valuation formula is consistent from year to year the comparison of projected and actual Schedule 5 valuations is valid.) The average age at expiry was chosen to be 60.

At once, there is a problem. The aim is to use the changes in the values in Schedule 4 to deduce the changes in the values based on Schedule 5, but this assumes that the valuation basis in Schedule 4 does not change. In practice, the appointed Actuary's basis changes quite often; in this case there are changes of both interest and mortality. Taking first the period from year 0 to year 3, we must adjust the Schedule 4 value in year 0 so that it reflects the valuation basis used in

year 3. This is done quite crudely as follows (taking the value of the benefits as an example).

Value based on Schedule 5 data, A67/70, 4·25% = 20941986
Value based on Schedule 5 data, A49/52, 6·75% = 14508853
Value from published Schedule 4, A49/52, 6·75% = 14246452
'Equivalent' Schedule 4 value, A67/70, 4·25%   = 1424652 ×
                                                                               20941986/14508853
                                                                            = 20563238

The calculation then proceeds as follows.

  (i) *Year 0; Schedule 4: A67/70 4·25%*
      Amount of benefit = 43548095
      Value of benefit   = 20563238 (see above)
      Average 'A'   =   ·47220
      Average age   = 41·22
      (The average age is 'x' such that $A_{x:\overline{n}|} = $ ·47220)
 (ii) *Year 0; Schedule 5: A67/70 7%*
      Amount of benefit = 43548095
      Value of benefit   = 13837845
      Average 'A'   =   ·31776
      Average age   = 42·25
(iii) *Year 3: Schedule 4: A67/70 4·25%*
      Amount of benefit = 45207988
      Value of benefit   = 22674765
      Average 'A'   =   ·50157
      Average age   = 42·74
      Therefore the change in the underlying average age in the Schedule 4 valuation was 42·74 − 41·22 = 1·52. The rest of the calculation works back from this to *deduce* the value of the benefits on the Schedule 5 valuation.
 (iv) *Year 3: Schedule 5: A67/70 7%* (estimated figure)
      Average age in Year 0 = 42·25
      Average age in Year 3 = 42·25 + 1·52 = 43·77 (estimate)
      Average 'A'   =   ·35024
      Amount of benefits = 45207988 (known from Schedule 4)
      Value of benefits   = 15833646

Because Schedule 5 was in fact available in Year 3, it is possible to carry out the valuation of the benefits and to compare the answer (which is 15821422) with the estimate. The error of ·08% is quite acceptable.

The projection of the value of the premiums is entirely analogous. To complete the picture, I show below figures for the actual and estimated values of benefits, premiums and liabilities, over different periods of projection.

Table 2

	Estimated	Actual	Error (%)
(1) Year 0 to Year 3			
Value of benefits	15833646	15821422	·08
Value of premiums	12142862	12037362	·88
Value of net liabilities	3690784	3784060	2·5
(2) Year 3 to Year 6			
Value of benefits	15618851	15449252	1·1
Value of premiums	8836161	8898949	·71
Value of net liabilities	6782690	6550303	3·54
(3) Year 0 to Year 6			
Value of benefits	15717100	15449252	1·73
Value of premiums	8962998	8898949	·72
Value of net liabilities	6754102	6550303	3·4

Note that the estimated value of the net liability is not a projected figure itself but is simply the difference between the projected value of the benefits and the projected value of the premiums (expense allowance being ignored); similarly for the actual value of the net liability. These figures are included because it is the value of the net liability which we really want to know. Being the difference of two larger numbers, it tends to have larger errors in the estimate but these are still within reason. I did try to project the net liability itself but this produced much larger errors.

Note also that the net liability can be very small and this makes it difficult to adjust the Schedule 4 values to allow for changes in the valuation basis.

4.10 The table below summarizes the results of applying exactly the same method to other offices' data. In each case non profit endowments were used. The 'rate of interest' given in the table refers to the independent (Schedule 5) valuation basis.

Table 3

Office	Period of projection	Rate of interest (%)	Percentage error in value of		
			Benefits	Premiums	Net liability
A	3 years	7	1·29	1·66	3·59
B(1)	2 years	7	2·78	3·25	21·8
B(1)	2 years	2	·79	5·58	26·9
B(2)	2 years	7	·49	·85	6·4
B(2)	2 years	2	·13	1·48	1·63
C	3 years	7	·15	·09	5·2
C	3 years	2	·04	·38	·72

Except for office B(1), these results seem reasonable. They do show the magnification of errors in calculating the net liability, especially office C at 7%. (In this case, the estimated values of the benefits, premiums and net liability were

7469647, 7381604 and 88043 respectively so a final error of 5·2% is actually quite impressive!)

4.11 The anomalous results for office B(1) call for comment. This was a new class of business, which at year 0 had only been in existence for two years. Thus the net liabilities would be very small, especially if the valuation basis was close to the premium basis, and large errors were to be expected. However, the large errors in the values of the benefits and the premiums on their own could not be explained by this.

In 2.3(vi) I pointed out that quinquennial grouping of data could be a problem and this is a very good example. The Schedule 5 data in the case of office B are given by unexpired term, individually up to 15 years and grouped quinquennially thereafter. Terms 20 and 25 years are likely to be more popular than intermediate terms when the policyholder takes out his or her policy, so if the policies have only been issued for two years, one would expect a lot of policies to have unexpired terms of 19, 20, 24 or 25 years and far fewer to have unexpired terms of 16, 17, 18, 21, 22 or 23 years. This distribution is concealed by the quinquennial grouping. The figures for office B(2) arise from estimating the data for individual unexpired terms up to 25 years and despite the unavoidable crudity of this, the improvement is quite remarkable.

4.12 The method has many problems and limitations, some of which are listed below.

(i)   It depends on the underlying age distribution, weighted by benefits or by premiums, not changing too much so that the changes in the underlying average age are not too different for different valuation bases. I tried to estimate 'second order' effects of the changing age distributions on the underlying age but with no better results. The problem is that great changes in the age distributions are not revealed by Schedule 4; one must await the next Schedule 5 which defeats the whole purpose of the exercise. As far as I can see there is no answer to this problem.

(ii) It relies on the valuation basis used by the office and published in Schedule 4; this basis changes often and therefore crude adjustments must be made.

(iii) The classification of policies must be the same in Schedule 4 and Schedule 5 if the correspondence is to be made. While this is almost universally the case, I did find one office whose non profit whole life policies were hopelessly confused in this respect.

(iv) Changes in the form of the DOT Returns as new regulations are introduced can change the classification of policies and destroy the continuity of Schedule 4.

(v)   Large amounts of new business, perhaps caused by inflation, can alter the age distribution with different effects on different valuation bases.

(vi) There is no way to include entirely new classes of business until a new Schedule 5 is published.

(vii) The method does not eliminate the magnification of errors in computing the net liability. On the other hand, I cannot think of any method which does.

(viii) While it may be applied to deferred annuity policies, it does not solve the problem of discovering whether the value, on the desired basis, of any cash option is greater than the value of the annuity or not. Again, I cannot think of any answer to this problem so this is not a particular criticism of this method.

4.13 Lack of time has prevented me from trying out other types of policies. I see no reason why this method should not work for most types of conventional business, the most testing class being deferred annuities, though perhaps it is too elaborate and too sensitive for term assurances and other classes with low reserves. There it may be satisfactory to assume that the ratio of premiums to reserves is constant over short periods. I have said nothing about unit linked business, because I do not see any way to proceed. Clearly this is a big omission, but it simply reflects my understanding of the DOT returns.

4.14 Within the limitations imposed by the Returns themselves, I think this was a reasonably successful attempt to update parts of Schedule 5. I regard errors of about 5% as small for this kind of estimation.

5. THE EVOLUTION OF THE RETURNS—PAST AND FUTURE

5.1 The Returns have changed in form from time to time, and the form of the Returns has frequently been discussed at the Faculty and the Institute. One such paper (6) is in the course of reading although it is already out of date, so perhaps a summary of the important changes in recent years would be helpful.

(i) The liability data in Schedule 5 has not changed much for conventional business but has been tightened up for unit linked business. This was one recommendation made by Ford in (6).

(ii) The asset data has changed a great deal since (6) was written. The market values must now be given, (Form 13) along with expected income (Form 45) and an analysis of non linked fixed interest assets (Form 46). In addition, for each unit linked fund a balance sheet must now be shown, allowing the prices of the units to be compared with the assets in the fund. If the amount of asset data seems rather bare, it should be compared with what used to be published. There was (in olden days) no requirement to publish market values (book values of the fund being published instead), and no requirement to segregate the assets of life and general business, if the office happened to be composite. This last item I find quite astonishing, and I can only assume that it stemmed from the days before the interactions of the assets and liabilities were considered to be as important as their amounts.

(iii) The data on movements during the year published in Schedule 3 has

improved a great deal but is still barely adequate. It allows a *general*
picture of the year's business to be built up but is no use for any detailed
work involving particular classes of business. I presume that it was not the
intention of those drawing up the Regulations that Schedule 3 should give
away such detailed information to the public and to competitors. It must
be remembered that the DOT has powers to ask for more details if it
wishes, so a more general picture may be considered to be quite enough
for public consumption.

(iv) Acquisition and maintenance expenses and commission are now separ-
ated in Form 41, a point recommended in (6). However, one point which I
find irritating is that the Analysis of Premiums and Expenses (Form 41)
and the Analysis of Claims (Form 42) do not give separate details, only
separate totals, for U.K. and overseas business. The asset data is worse,
not even giving separate totals. This would be a handicap if any one
branch of the business had to be considered in isolation.

5.2 We have today, Returns little changed for over a century while actuarial
thinking and policy design have advanced rather more. The discussions of
immunization after the War drew attention away from single figure valuations,
or one-dimensional solvency if you like, and made it clear that more was needed.
One had to look at the spread of assets and liabilities together, so two dimensions
were needed to treat the variations as well as the means of the actuarial values.
The DOT Returns have recently come closer to allowing for this by improving
the asset data. Matters are not standing still though, and recent discussions of
solvency in (18) have come out in favour of a stochastic or Monte Carlo
technique, where a model of the life office is projected into the future, allowing
investment conditions, inflation and so on to be stochastic variables. After
several thousand such simulations, one can estimate a probability of solvency.
The data required for such a model are the same as those needed for a valuation
by emerging cost techniques, which has always had its advocates. Data which are
sufficient to value the liabilities by commutation columns should also suffice for
an emerging cost valuation, so I do not think any radical changes are required in
principle to the conventional business in Schedule 5. However, one of the useful
properties of emerging cost techniques is the ability to test the effect of
decrements other than death or maturity, and in this connexion more
information on movements by class of policy in Schedule 3 would certainly be
helpful, in particular amounts of claim, benefits and premium 'off' split by class
of policy. In some circumstances, solvency could be threatened by a poor lapse or
surrender experience in the near future more than by a poor mortality or
investment experience in the far future.

5.3 The Faculty Working Party on Solvency concluded in (18) that the
supervisory authorities should take some account of likely new business in the
immediate future. This contradicts in some ways the established practice of
valuing existing business only but it does recognize the adverse effect of new

business on solvency, namely that it absorbs capital. Over the longer term, of course, it brings in more expense loadings but it is very bad practice to use these as a crutch for existing business. Various authors discussing the price of a life office ((11) and (12)) have commented on the difficulties of projecting the future new business. The actions of the office are always subject to future management decisions; bearing this in mind the level of new business data given in Schedule 3 is probably reasonable. In particular, new business split by each class of policy is now given. The method of estimating future new business is then a matter for the judgement of the actuary.

5.4 The viability of a life office, especially a unit linked life office, depends on its actual expenses in relation to expense loadings in policies.

From the details of policy design given in Schedule 4 it is possible to deduce the expense loadings to be expected from unit linked business, and from the percentage of office premiums valued under conventional business a rough idea of the expense loadings from this source can be had, though it may not be possible to disentangle expense and profit loadings. (Note that the relationship of certain charges to fund size under unit linked business requires assumptions as to future investment conditions.) If the office cannot operate within these loadings it is not solvent on the basis chosen. However, the data on actual expenses are limited to those in Form 41, and like all aggregate figures these could hide a great deal. I would like to see more detailed figures showing different types of expenses such as those related to branches and head office, salaries, capital items, servicing of different types of business, investment, group pensions, advertising, product development and so on. It may be that such details are too revealing to be published but if I was interested in solvency I would want to see them. Moreover, the DOT has a certain responsibility to look at the 'reasonable expectations of policyholders' (see 3.1(i)) and cross-subsidization of expenses is just as significant as cross-subsidization of bonus.

I think that expenses will bear closer examination in the future. Modern policy design has tended to reduce the guarantees built into non-profit contracts, so that policy charges, fund charges and so on can be increased. This allows greater freedom in setting the level of benefits but it must imply that charges will be maintained at a realistic level. Failure to do so, because of competitive pressure or other reasons, will mean that new business is subsidizing old business. Undoubtedly, the high inflation of the 1970s means that new business is today subsidizing old business, but modern policies have provisions which should avoid this happening again to the same extent and for the sake of equity such provisions ought to be exercised.

5.5 The asset data are scanty compared with the liability data, but there are good reasons for this. The assets may be here today and gone tomorrow; if the office changes its investment policy it could turn the portfolio upside-down in a relatively short time. In the long term it does not matter if, for two months in 1985, the office was long in Marks & Spencers and short in ICI; indeed on a larger scale it does not matter that the office was long in 'Stores' and short in

'Chemicals' These facts have no long term predictive quality, though they may in retrospect matter a great deal to the policyholders. Significance is only reached at the broad level of 'gilts', 'equities', 'property' and so on, and this is what the returns provide (plus an analysis of fixed interest stocks to allow a consideration of matching). A long list of individual holdings would therefore be a waste of time.

In contrast, once the office has sold a policy it is stuck with it. It is not possible to buy and sell liabilities as one can buy and sell assets, so a long list of individual holdings (in other words Schedule 5) is relevant. This appears to me to be a qualitative difference between the levels of data which needs to be provided for assets and liabilities.

5.6 A lot can happen in five years, and I think that Schedule 5 should be published more frequently, preferably annually as recommended in Ford's Paper. The obvious, and compelling, argument against this is that of cost and effort to the life office.

To meet the problem of new classes of policy, in the absence of annual Returns I would at least like to see Schedule 5 data published for the first 5 years after the issue of any new class of policy. One major change would be the publication of enough data to allow the profit-testing of unit linked contracts for the remainder of their terms—at present it seems that year by year data is adequate. Minor changes which I would like to see made to Schedule 5 are

(i) Endowment data published for individual unexpired terms up to 25 years instead of 15 years as at present.
(ii) Full details given of cash or annuity options, not just details of those which were actually valued by the office.

5.7 It is not possible to mention the place of unit-linked business in the returns without commenting on a change in the underlying philosophy which unit-linked business seems to have brought to the surface. A lot of policies are now very complicated to describe, with a multiplicity of funds, features and options. To list all the business in detail in Schedule 5 may well involve unreasonable labour and result in masses of paper. The task is possible but, from the office's point of view, undesirable. What is more important is that from the DOT's point of view it is unnecessary because they can and do ask for more information. It is true that the data as presently published will allow a rough examination of the office's own valuation, to see if it is reasonable, but this is very far from being an independent valuation.

I think that the ideal of allowing an independent valuation to be made has not been taken too seriously by the offices or the authorities, possibly because very few are actually made. It was the advent of a new type of business, for which the existing returns were not fitted, which made this obvious.

5.8 Is the above simply a fact of life, or should it be construed as a criticism? It may be that the form of life assurance as it is now transacted means that the old safeguards have outlived their usefulness. If the recommendations of the Faculty Working Party in (18), for a stochastic test of solvency, were to be accepted as

standard actuarial practice, it is easy to foresee the published Returns being replaced by a computer tape to be sent by the office to the DOT. Given that the supervisory body is active, alert and actuarial, is there any reason why 'freedom with supervision' should be inferior to 'freedom with publicity' (always with emphasis on the 'freedom')? Indeed it is interesting to see that George King (8) said in 1891 that "in connection with insurance legislation it would, therefore, appear that the most important point for discussion is, whether the system of Freedom with Publicity, or that of Government Control, should prevail. This *question seems to me to be entirely one of expediency*". He then went on to argue strongly against Government Control. At that time, however, the degree of state interference in *any* sphere of life was minimal. The life offices' returns were deposited with the Board of Trade and were published but that was all; the Board had no powers. It is very clear from contemporary papers that the idea of a policyholder, or potential policyholder, being able to use the Returns (with some help from an actuary) to pick out a good office was taken seriously. The conditions which then prevailed have nearly all changed. We have statutory minimum valuation bases, asset regulations, solvency margins and intervention powers on the part of the DOT. At the time of writing, it seems possible that unisex pension rates will be imposed by statute. Despite this, U.K. life offices still have considerable freedom but in keeping with the times the idea of 'the public' watching over the offices has been made concrete by assigning the task to a public body. In the process, the independent actuary has been demoted from a participant to a spectator. The purpose for which the Returns were originally intended is being satisfied whether or not they are made public; the significance of the fact that the DOT asks for unpublished information will not be missed. One could argue that shareholders are protected by Stock Exchange rules, and that policyholders' 'reasonable expectations' are also now looked after by the DOT, so the place of the published returns is diminished. As time goes by, this would lead to the quality of the published information being neglected. In my opinion this would be regrettable. The life assurance industry is unusual in that the sale of the product is not the end of the story but the beginning, and it is ridiculous to suggest that the same type of financial reporting will deal with a life office and, say, a manufacturer of ballpoint pens. Shareholders and policyholders (or in practice, stockbrokers and insurance brokers) must have access to material which gives a realistic view of the office. It is not enough to rely on the DOT to sort out the sheep from the goats; at the point of buying a policy or a share the object is to select the healthiest office, and it is better not to have to rely on figures which the offices are willing to provide (such as projected benefits!). In fact, if it should come to pass that offices do simply send a computer tape to the DOT, I think that some reasonably detailed form of public financial reporting would have to continue. Whether this should be such as would allow an independent actuary to carry out a valuation is another matter.

5.9 Before you turn to more rewarding subjects, spare a thought for the DOT Returns. Nobody loves them, hardly anybody uses them, but if the requirement to publish them was not there would we be better off or worse off?

A. S. MACDONALD

6. ACKNOWLEDGEMENTS

REFERENCES AND BIBLIOGRAPHY

(1) *Insurance Companies Acts and Regulations* (H.M.S.O.).
(2) *Policyholders Protection Act 1975* (H.M.S.O.).
(3) 'Report on the Policyholders Protection Act 1975' (June 1981) (H. of C. paper).
(4) ABBOTT, W. M. (1982) 'Insurance Companies Legislation' (ATS special note).
(5) PICKFORD, M. A. (1982) 'The Insurance Companies Act 1981 and some of the Associated Regulations' *J.S.S.*, **26,** 69.
(6) FORD, A. (1974) 'Life Office Returns to the Department of Trade and Industry' *J.I.A.*, **101,** 53.
(7) SPRAGUE, T. B. (1870) 'On legislation as to Life Insurance and Life Insurance Companies' *J.I.A.*, **16,** 77.
(8) KING, G. (1891) 'On legislation affecting Life Assurance Companies' *J.I.A.*, **29,** 481.
(9) 'Supervision of Insurance in the UK (1972).' *J.I.A.*, **98,** 233.
(10) SMITH, P. R. (1973) 'More Informative Disclosure of Life Office Affairs' *J.I.A.*, **99,** 249.
(11) BANGERT, R. M. (1972) 'Valuation of a Life Assurance Company for Purchase' *J.I.A.*, **99,** 131.
(12) DERBY, P. J. and RICE E. A. (Jan. 1978) 'The Evaluation of Proprietary Life Assurance Shares' *G.A.S.S.*
(13) SCOTT, H. J. A. (March 1978) 'Life Offices' Valuation Statements' *G.A.S.S.*
(14) BEWS, R. P., SEYMOUR, P. A. C., SHAW, A. N. D. and WALES, F. R. (1976) 'Proposals for the Statutory Basis of the Liabilities of Long-term Insurance Business' *T.F.A.*, **34,** 367.
(15) BAKER, A. C. and GRAHAM, N. S. (1977) 'Some thoughts on Solvency of Life Assurance Companies' *T.F.A.*, **35,** 474.
(16) BROWN, A. S., FORD, A., SEYMOUR, P. A. C., SQUIRES R. J. and WALES F. R. (1979) 'Valuation of Individual Investment Linked Policies' *T.F.A.*, **36,** 343.
(17) PLYMEN, J. and WOODWARD, D. L. (1980) 'Life Assurance Profitability, Performance and Prospects' *T.F.A.*, **37,** 158.
(18) 'The Solvency of Life Assurance Companies' (Faculty Working Party) presented to the Faculty in October 1984.
(19) BARROW, G. E. and FERGUSON, D. G. R. (1984) 'A Review of the Law Relating to Insolvent Life Insurance Companies and Proposals for Reform' *J.I.A.*, **111,** 229.