

**REFLECTIONS ON RESILIENCE:
SOME CONSIDERATIONS OF MISMATCHING TESTS,
WITH PARTICULAR REFERENCE TO NON-LINKED
LONG-TERM INSURANCE BUSINESS**

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ABSTRACT

The paper considers the valuation for solvency purposes of traditional long-term insurance business. It concentrates on without-profit business, and discusses the reserves that are required to protect against the contingency of sudden adverse changes in asset values (the 'mismatching' or 'resilience' test). The details of a suitable test, and a method of applying it in practice using a 'matching rectangle', are described. Investigations into the effectiveness of such a test, using both deterministic and stochastic methods, are followed by concluding remarks on the underlying philosophical issues raised.

Full numerical results are presented in the Appendices.

God grant me the serenity to accept things I cannot change, courage to change things I can, and wisdom to know the difference.

Reinhold Niebuhr

1. INTRODUCTION

1.1 A year ago the above authors presented a paper, 'Proposals for the Statutory Basis of Valuation of the Liabilities of Linked Long-Term Insurance Business'⁽¹⁾ to the Institute, and subsequently to the Faculty. In that paper ('our earlier paper') it was indicated that consideration was also being given to several other issues, including possible refinements to the Government Actuary's resilience test (see §§ 1.9 - 1.12) and further investigation of the practical application of that test to non-linked business.

1.2 The current paper is the result of our consideration of these two key issues.

1.3 Many readers, particularly those not involved with linked business, may not have studied our earlier paper in detail. To assist them, and for convenience of subsequent reference, the current paper is intended to be self-contained. Accordingly there is, where necessary, repetition of earlier material and duplication of previous ideas – though, it is hoped, no inconsistencies. In particular, the rest of this introduction may be omitted by those familiar with the earlier paper.

1.4 Statutory valuations of long-term insurance business under the Insurance Companies Act 1982 ('the Act', which superseded the 1974 and 1981 Acts) and the Insurance Companies Regulations 1981 ('the 1981 Regulations') have now been prepared by actuaries for some years. Similarly the guidance issued by the profession to Appointed Actuaries, specifically GN1 and GN8, has also remained substantially unchanged over that period (until very recently). The time was opportune for valuation practice to be reviewed in the light of recent experience.

1.5 In particular, in the recent past, considerable attention has been given to the need for actuaries to ensure that their reserves are resilient to financial (and other) changes. A memorandum issued by the Government Actuary to Appointed Actuaries dated 13 November 1985 indicated the magnitude of fluctuations in asset values that he regarded as a reasonable test for this purpose.

1.6 Additionally there were more specific needs in relation to linked business: these were addressed in our earlier paper.

1.7 For all these reasons, therefore, late in 1985 the Institute and Faculty Joint Working Party with the Government Actuary's Department (the 'Joint Actuarial Working Party', or 'JAWP') was re-established to consider these issues. To assist the JAWP, in April 1986 the Institute and Faculty Councils set up a further Working Party, the Joint Research Working Party on Valuation Regulations (the 'VRWP' or just the 'Working Party') to investigate topics within the broad areas described in §§ 1.4 to 1.6, as requested by the JAWP. The members of the VRWP (chaired by Mr D.E. Purchase) are the authors of the current paper. The authors wish to acknowledge the contribution made by colleagues in their various offices who have given invaluable help in preparing the numerical examples and typing the drafts of this paper.

1.8 The remainder of this paper is structured as follows:

The rest of this section summarizes comments on the Government Actuary's resilience test (the 'working rule') made in Section 2 of our earlier paper.

Section 2 sets the working rule into its theoretical and statutory context, and discusses its interpretation, in greater detail than in our earlier paper. Section 3 describes a spread-sheet model, using a 'matching rectangle', which can be used to apply the working rule to a portfolio of non-linked business.

Section 4 gives the results of investigations into the effect of the working rule on some simple hypothetical combinations of assets and liabilities. Section 5, in contrast, uses stochastic methods to assess the effectiveness of the working rule.

Section 6 summarizes our conclusions, and returns to the more general issues.

1.9 As already mentioned, in recent years considerable attention has been given, by the Government Actuary's Department (GAD) and by Appointed Actuaries, to the need to ensure that reserves are resilient to financial changes,

as required under Regulation 55. At the First United Kingdom Actuarial Convention, in Birmingham, on 12 September 1985, Mr C.L. Cannon of GAD described the 'working rule' which was being used by the Department when felt necessary⁽²⁾. Although there was some initial surprise, actuaries soon became more used to the idea of the test. After the market movements of October 1987 any remaining doubts as to the extent of the fall to be tested are surely academic!

1.10 The test was promulgated more widely through the Government Actuary's memorandum to Appointed Actuaries mentioned in §1.5 (reproduced, with permission, in Appendix 1). In essence the test required actuaries to consider the adequacy of their reserves in the context of immediate falls in asset values of 25% in equities (and similar investments, including property) and also the changes in values equivalent to a rise, or a fall, of 3% in the yields on gilt-edged and other fixed-interest stock. This memorandum was followed by Temporary Practice Note 2 to GN8, issued by the Institute and Faculty to members in May 1986 and contained in the Institute's current Members' Handbook on page D/67 (Faculty page C/33).

1.11 It should be noted at this point that 'mismatching' is here being used in the specific context of a difference between the effect of a change in market yields on the aggregate value of the assets and the effect of the same change on the aggregate value of the liabilities (to quote TPN2). This is sometimes described as 'big bang mismatching' to distinguish it from the 'cash flow (mis)matching' of traditional actuarial theory (the importance of which is also emphasised in the Government Actuary's memorandum). For this reason some have advocated phrases such as 'resilience testing' for the newer concept. Whilst this might be more apt, the 'mismatching' usage is currently dominant. In this paper both phrases will be found, but when 'mismatching' is used it is always (unless specifically stated otherwise) in the context of an immediate change in asset values.

1.12 Whilst on terminology, the GAD test as a whole, including the numerical values set out in §1.10, will normally be referred to in this paper as the 'working rule': the term 'benchmark' is sometimes used with a similar meaning.

1.13 The different sections of this paper represent the results of separate lines of investigation pursued by various members of the Working Party. There is not, therefore, total consistency between all aspects of the different approaches and, where significant, differences are pointed out in the text. We believe, however, that these inconsistencies are not sufficiently material to detract from the results obtained.

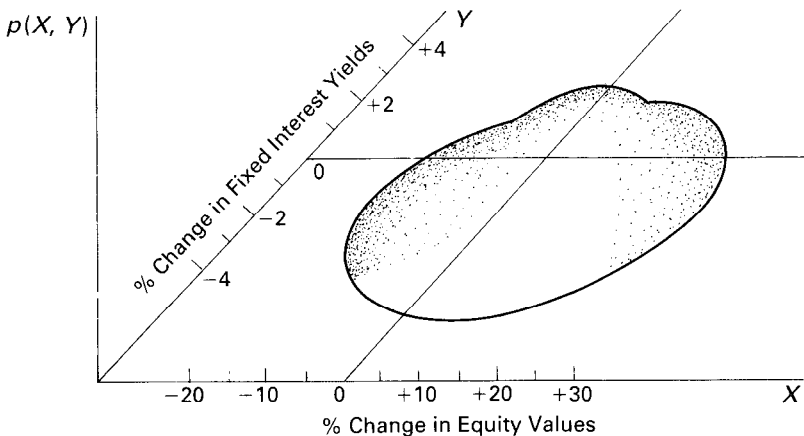
2. OBSERVATIONS ON, AND INTERPRETATION OF, THE WORKING RULE AS IT AFFECTS NON-LINKED BUSINESS

2.1 As a preliminary to an examination of the working rule, it may be helpful to restate some of the comments made in our earlier paper regarding the ambiguities surrounding the interpretation of the working rule test as it applies

to equities and the problem of coherence. The points made on those topics in that earlier paper are equally valid for non-linked business and for ease of reference §§ 2.6–2.9 are here reproduced as Appendix 2.

2.2 As already mentioned, this paper concentrates on the type of mismatching envisaged in the Government Actuary's memorandum. However, the need for actuaries also to have regard to mismatching of the 'traditional' (i.e. cash flow) type should be borne in mind. The tests apply to the whole of the business of a UK office, i.e. including overseas business. Where a UK actuary is advising an overseas life office (not operating in the UK) the tests are not directly relevant. However, the actuary may feel that in order properly to fulfil his professional responsibilities (see GN5) he should have regard to comparable tests when establishing reserves for such an office. It may be appropriate to note that the application of the tests in the case of a non-EC insurer with a UK branch is not clear, although Regulation 55 would apply to the world-wide DTI returns of such an insurer. It is also appropriate to note that the question of mismatching reserves raises some special issues for reinsurers, particularly where permanent business (unit-linked or with-profits) is reassured on a full co-insurance basis. We have not attempted to address these, or other specialist issues in the current paper.

2.3 It is easy to feel that the hypothecation of assets in the working rule test should have regard to the suitability of those assets in terms of traditional matching. However, our understanding is that such an approach is unnecessary. Under the working rule test, as we understand it, one is purely testing the ability to establish adequate reserves in defined conditions. There is no reason to suppose that an 'unsuitable' asset in the traditional matching sense will be less satisfactory for that purpose than, say, a gilt-edged stock. 'Unsuitability' in terms of the working rule test should be dealt with by the conditions of that test; not by some external attribution of relative suitability. It hence follows that any assets (other than linked assets which are implicitly assumed to cover unit



liabilities) in the office's portfolio can be hypothecated for the purpose of the working rule test.

2.4 Before considering the working rule in detail it is helpful to look at it in a theoretical context. One can visualize a probability distribution for a sudden change to different economic conditions centred on current conditions. If one assumes there are two main components of change, i.e. a rise or fall in the value of equities and property and a rise or fall in the yield on fixed interest assets, then the distribution might take the form of a bivariate probability distribution centred on the origin (representing current conditions), as shown opposite. If one could express the probability of insolvency for the office as a function for every point in the (X, Y) plane, then a mismatching standard could be set by requiring the mean probability of insolvency for the office, weighted by the probability distribution for sudden changes in economic conditions, to be less than some specified standard. It should be noted that such a test would, to some extent, overcome the 'coherence' problem of the working rule. That is, when conditions have changed by, say, -25% and $+3\%$, whether one should then assume a further change of -25% and $+3\%$.

2.5 The actual working rule differs from the theoretical 'ideal' described above in two main respects. Firstly, the tests are required to be carried out at only two points of the (X, Y) plane, i.e. $(-25\%, +3\%)$ and $(-25\%, -3\%)$ although it could be argued that tests at other points, for example $(0, +3\%)$ and $(0, -3\%)$ are also necessary. Indeed, there are occasions where $(+25\%, 0)$ would result in a need for mismatching reserves. Secondly, the condition that needs to be met is of a zero 'probability of insolvency' at the test points, where 'insolvency' means an inability to set up the statutory minimum valuation reserves under the 1981 Regulations.

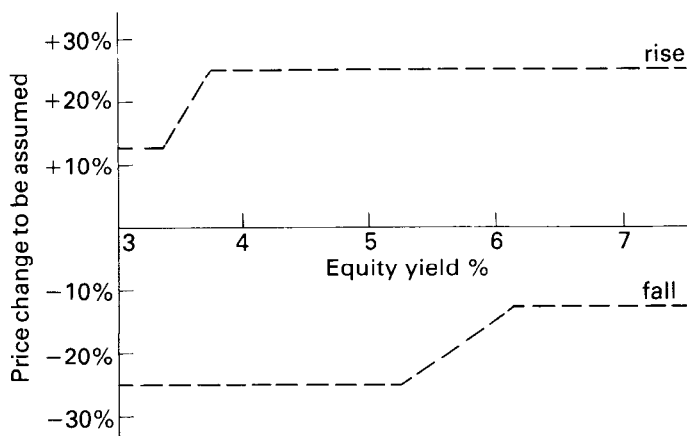
2.6 Variations on the rule can be developed. For example, it may be felt that the variation assumed in equity prices should have some regard to prevailing market levels. As is shown by Appendix 3, UK equity yields have tended to move within the range $3-7\%$. A possible rule would, therefore, be to modify the $\pm 25\%$ assumption so as to assume price movements which did not take the yield outside that range, subject to a minimum movement of $12\frac{1}{2}\%$ (i.e. half of the normal variation). The practical effect of such a rule would be as shown in the following table:

<i>Prevailing equity yield</i>	<i>Price changes to be assumed in test</i>
6.125% or more	+ 25%, - $12\frac{1}{2}\%$
5.25%	+ 25%, - 25%
3.75%	+ 25%, - 25%
3.375% or less	+ $12\frac{1}{2}\%$, - 25%

(With linear interpolation between 6.125% and 5.25% and between 3.75% and 3.375%)

The limits are shown graphically overleaf.

2.7 A similar approach could be taken to the fixed interest yield variation.



Modified Equity Rule proposed in §2.6.

The effect of a -3% change in, say, a 5% interest climate arguably represents a far stronger test than was ever intended. A simple modification would be to provide for a fall of the lower of 3% and, say, one-third of the current fixed interest yield. A similar problem exists at high interest rates, particularly in view of the maximum reinvestment rate restriction in the statutory minimum basis. It is suggested that a further rise of only $1\frac{1}{2}\%$ need be assumed when the prevailing level of interest rates exceeds 15% .

2.8 With the above theoretical framework in mind, the remainder of this section looks at the practical interpretation of the working rule. The two main topics covered are the method of carrying out the necessary calculations and the treatment of other types of asset. The section ends with some comments on currency mismatching.

Calculations under the Working Rule

2.9 The basic approach is set out in §1.10. In determining the minimum reserves it is assumed that the absolute amount of interest or dividend is unaltered by the sudden change in market values of the assets. In determining the maximum valuation rate of interest one has regard to the redemption yield on fixed interest investments after the rise or fall in value and the running yield on equities or property after the fall in value.

2.10 The admissibility limit regulations contained in Schedule 8 of the 1981 Regulations also require consideration. It is possible that assets which are wholly admissible in current conditions will not be so in the changed conditions of the working rule test, or assets which are currently inadmissible will become admissible in the changed conditions. However, in practice the initial hypothecation of assets gives some room for manoeuvre and admissibility is unlikely to be a serious problem.

2.11 Calculating the reserves on the statutory minimum basis in the revised

conditions raises the question of how precisely the minimum reserves should be calculated. The point is of particular relevance in relation to the '7.2% maximum after 3 years' restriction when considering the (-25% , $+3\%$) situation. The W_2 and other methods (described in Appendices 4 and 6) would seem to us to be appropriate methods as a minimum basis for valuing non-linked business. In practice it may often not be necessary to go to the extreme of W_2 to demonstrate a certain (or zero) mismatching reserve. Furthermore, these methods may not yet have received sufficient consideration by the profession for them to be regarded as acceptable by the statutory authorities. Whatever method is followed, if contracts include financial guarantees such as annuity options, then care is needed to allow for the necessary reserves in the new conditions.

2.12 The use of a 'matching rectangle' as a way of organizing and summarizing the mismatching calculations may be helpful. Such an approach forms the basis of the practical method described in Section 3.

Treatment of other Types of Asset

2.13 In applying the working rule, as specified, for fixed interest and equity-type assets, corresponding assumptions should be made for other types of asset. This section suggests what those corresponding assumptions should be, although the actuary should, of course, use his professional judgement in deciding the appropriate treatment in particular cases.

2.14 Cash, variable loans, variable mortgages, debts with variable rates of interest and debts due within one year can be assumed to suffer no change in value in the working rule conditions. Similarly, it would seem appropriate to assume no change in value for computer equipment and office machinery etc. in view of the heavy DTI write-down that already exists. Where an asset is income-producing, it seems appropriate to retain the $\pm 3\%$ assumption.

2.15 For index-linked gilts the broad equivalent of the $\pm 3\%$ conditions would seem to be a $\pm 1\%$ change in real gross redemption yield. As an alternative, for simplicity, $\pm 1\%$ change in the current running yield is suggested. An example might make this clearer. If a stock with a 2% coupon was issued when the RPI was 100 and if the RPI now is 120 then the next half yearly payment of interest is

$$2\% \text{ divided by 2 times } \frac{120}{100} = 1.2.$$

The annual payment is thus 2.4. Suppose the price now is 100, then the current running yield is 2.4%. Take the reduced value of the index-linked gilt in the

$+1\%$ climate for the purpose of the working rule as $\frac{2.4}{3.4} \times 100$.

2.16 Fixed interest loans and debentures, all types of convertible loan stocks, preference shares and debts without a variable rate of interest and not due within one year can all be valued using the $\pm 3\%$ approach. Convertibles should

be valued to the first conversion date. In that respect it should be noted that the somewhat anomalous treatment of convertible stocks standing above their redemption value under the Insurance Companies (Accounts and Statements) Regulations 1983, which can result in negative yields in Form 46 of the DTI Returns, will presumably also apply in this context. (Note: it is understood that in practice the DTI have been prepared to grant a section 68 order allowing such assets to be classed as equities.)

2.17 The treatment of property assets calls for particular comment. When the working rule was first promulgated, properties were not mentioned, though it appeared that they were to be classed as equities for resilience purposes - an interpretation noted in TPN2. It can however be argued that, as the volatility of property values, judging by recent experience in the United Kingdom, is much lower than for equities, a smaller percentage fall should be demanded. Whilst the argument is attractive, the Working Party has some reservations. Reliable data on property values is not available for as long a period as it is for equities. Some overseas experience, both in Europe and elsewhere, suggests that significant falls cannot be ruled out. And the valuation of a property portfolio is itself a more subjective matter than the equivalent for the generality of equity holdings. We therefore feel disinclined to propose a specific different test for property assets, although we would not dissent if a somewhat lower, but effectively arbitrary, percentage fall were to be adopted as standard.

2.18 Warrants, options and traded options etc. are nil yielding and are all wasting assets. Because of the gearing effect, the working rule ought to allow for a much larger drop than that applicable to equities and property. For simplicity the assumption of a 50% reduction in face value is suggested. In the case of a futures contract it seems appropriate to regard it as a basic investment coupled with an option and to consider each part separately in accordance with the relevant treatment.

2.19 It is worth noting two other points regarding the treatment of assets. Firstly, in the initial hypothecation exercise it will normally be possible to avoid the complications of including minor classes of asset such as traded options in the hypothecated assets. Secondly, although the inclusion of non-interest bearing assets, where no change in value need be assumed, reduces the volatility of asset values in the working rule conditions, there is a trade-off in that the inclusion of such assets depresses the yield thereby increasing the stringency of the minimum basis.

Currency Mismatching

2.20 The actuary should also have regard to any mismatching by currency between assets and liabilities. (The possible extent of such mismatching is, of course, limited by Regulation 25.) There seems no simple logical extension of the working rule tests which could be used to determine the reserves required to cover such mismatching. However, it could be considered appropriate for the size of the currency fluctuations to be assumed to vary according to the stability and relative strengths of the currencies concerned, for example by assuming a

larger change in value than 25%. It is also worth noting that a depreciation in value of an asset denominated in a foreign currency due to exchange rate movements has no effect on the yield on that asset (in the relevant currency). The effects of such depreciation are, therefore, generally more dramatic in terms of the consequent need for a mismatching reserve than a comparable reduction in value of a sterling asset due to a yield change. In the above discussion it has been implicitly assumed that there is no mismatching by currency, but such mismatching would seem an area worthy of separate consideration. The position of overseas business needs especial attention in that connection.

3. A PRACTICAL METHOD OF APPLYING THE WORKING RULE

3.1 This section looks at the calculations required in respect of non-linked business. No reference is made to linked liabilities or to current liabilities.

3.2 To demonstrate compliance with the maximum valuation interest rates defined in Regulation 59, assets can be notionally apportioned to various categories of liabilities. For this purpose the assets are taken at the values indicated by the asset valuation regulations (broadly market values), corresponding to the fact that Regulation 59 defines yields in relation to such values. On this basis, the amount of assets available for notional apportionment will normally exceed the amount of liabilities, so there will be some latitude in which assets are selected for this exercise, as well as in how they are notionally apportioned. The amount of liabilities covered will be the total mathematical reserves including cost of bonus (i.e. Form 14 lines 11 plus 15), plus any additional amount held in respect of contingent liabilities (e.g. contingent tax on capital gains) as will be mentioned in the footnote to Form 14. At this stage the mismatching reserve itself will not be included, because this is the beginning of the process by which its amount is determined, although there will be a presumption about which further assets will be available for apportionment to it when it has been calculated.

3.3 In complying with Regulation 59, the highest permissible valuation interest bases (and hence the minimum reserves) will be achieved if the assets are considered in descending order of gross yield, up to the amount of the liabilities, with the lowest-yielding assets omitted. However, this order of yield may not be the same after a move to one of the working rule conditions (especially ‘– 25%, – 3%’), and to demonstrate compliance with the Regulations in those conditions it is permissible to make use of a completely different apportionment. Thus, within this overall approach, assets can be apportioned notionally to the liabilities in the most appropriate (or most expedient) way at any stage, as discussed in §2.3, so as to minimise the resulting mismatching reserve, having regard to the respective volatilities of assets and liabilities.

3.4 In the method described in this section it is, accordingly, assumed that the assets are considered in descending order of gross yield. The outcome of applying the method is shown in Appendix 5 and the following references to tables are to tables in that appendix.

3.5 Table 5.1 shows how the notional apportionment can be set out in the form of a 'matching rectangle', showing which assets are apportioned to which liabilities. In the example:

- (i) The figures are for illustration of the method, and are not intended to carry any message about the results.
- (ii) Only a limited range of categories of liabilities is shown. In practice the range of classes of business and of different valuation bases may call for a much larger number of categories, as indicated in Table 5.7.
- (iii) The number of categories of assets is also limited, and in practice a wider range may also be used here, as indicated in Table 5.8. In particular, fixed interest assets could usefully be analysed by outstanding term.

In practice inclusion of the valuation rates of interest for the liabilities and of the yields (less margin) for the assets would make the table a convenient working sheet for demonstrating compliance with maximum valuation rates of interest.

3.6 On a move to one of the working rule positions, the requirement is to have sufficient reserves to continue to cover the minimum liabilities calculated in accordance with the Regulations. This means that a new notional apportionment of assets can be made, but in the simple example illustrated in Tables 5.1 - 5.3 the same apportionment is retained. On application of the working rule the total values of the assets will alter accordingly, and for a given class of asset the values of the individual amounts apportioned to each category of liability will alter in proportion to the alteration in the total value for that asset. For example, in the column headed 'Land' in Table 5.2, the asset values are each 75% of the corresponding value in Table 5.1. At the same time, each category of liability is re-valued on a basis corresponding to the statutory minimum in the new conditions. For example, it is assumed that the total liability in the general annuity fund is reduced from 9,880 (Table 5.1) to 7,885 (Table 5.2). Hence, in the row 'General annuity fund' each figure for liabilities in Table 5.2 is $7885/9880$ of the corresponding figure in Table 5.1.

3.7 For each cell in the matching rectangle there is now a new asset value and a (different) new liability value, showing a surplus or deficit for the cell. For the example in Table 5.1 the revised position is as shown in Table 5.2. This shows an overall deficit of 45,692. In this example, and assuming that higher yielding assets have already been apportioned, this will mean a mismatching reserve in the form of a further 60,923 ($= 45,692/0.75$) of equities at current values. With the addition of this amount, the revised total value of apportioned assets in the working rule conditions will now be equal to the revised total liabilities. An example of an apportionment of this total is shown in Table 5.3. As in Table 5.1 asset yields are also shown.

3.8 The full detail is not essential to the process of arriving at a mismatching reserve, but it does give a useful picture of how its amount arises and which parts of the portfolio contribute most to it. It can also give a lead to where significant mismatching occurs, and to whether a different notional apportionment of assets might be appropriate, either in the current conditions or in the working

rule conditions. Because of the interactions between the apportionment of assets and the minimum valuation bases for the various categories of liabilities, a number of trial calculations may be needed. Alternatively, a systematic mathematical approach to minimizing the mismatching reserve is possible.

3.9 When a matching rectangle has been set up in this way for a working rule, each cell shows the effect for one category of liability backed by one class of asset and, as will be seen, corresponds to the sort of single result described in Section 4 for an individual theoretical case. By starting from results of the kind shown in Section 4 and setting them out in a matching rectangle format, the position of any office can be considered as the combination of a number of such theoretical cases with suitable weightings.

3.10 Whether analysing a given total portfolio or building up to a hypothetical portfolio from simple components, it should be noted that successive approximations may be needed to arrive at a set of valuation bases which individually and in total come as close as possible to the statutory minimum valuation basis. Also, because of the freedom to use different groupings of liabilities, different notional apportionments of assets to liabilities and different mixes of stronger and weaker valuation bases, the calculations can in one sense be regarded as a purely theoretical exercise to find the minimum mismatching reserve which will satisfy the working rule.

3.11 If an office's published valuation is at the statutory minimum, which is the assumption for the hypothetical situations considered in Section 4, mismatching reserves will normally be required. In practice, the published valuation bases used will usually be stronger in various respects than the statutory minimum, and there may be various non-specific additional reserves. To the extent that there is no other contingency that these margins and additional reserves are deemed to cover, they can be used towards the required mismatching reserve, or indeed be treated as being the mismatching reserve, or part of it. As a result it may be found that the explicit mismatching reserve can be reduced or extinguished, even though it would have been needed if the published liabilities were calculated on the statutory minimum basis. It should, however, be noted that the actuary should ensure that any mismatching reserves would enable him to set up office reserves in the changed conditions which he would regard as adequate. Those would not necessarily be at the statutory minimum level in the new conditions, but may need to be at some higher level. It should also be noted that, although the Government Actuary's memorandum specifically states that Regulation 55 need not be met in the changed conditions, the requirements of Regulation 54 would appear to continue to apply. Each actuary needs to have regard to the circumstances of his own office in applying the test.

3.12 The example illustrated in Tables 5.1–5.3 of Appendix 5 makes no reference to any provision for contingent tax on capital gains (that is, the prospective liability to tax on capital gains which would arise on the sale of the assets to which it applies). As mentioned in §3.2, this may be part of the 'additional amount' which has to be mentioned in the footnote to Form 14 of the DTI return, and in practice it is helpful to consider the two together.

Contingent tax on capital gains can be included as a category of liability in the matching rectangle, and in the working rule conditions it will have a different value (depending on the relevant capital appreciation, less indexation, and the proportion of assets deemed to relate to taxable funds). In general, this will mitigate the effect of a fall in capital values. An example is shown in Tables 5.4–5.6, which correspond to Tables 5.1–5.3.

3.13 In the example, the contingent tax on capital gains (referred to as ‘contingent CGT’) is taken as 10,000 in current conditions, reducing to 1,000 in the ‘+ 3%, – 25%’ condition. The effect of holding assets equal to this contingent liability of 10,000 is to reduce the further amount needed in respect of mismatching reserves (as compared with the amount illustrated in Tables 5.1 – 5.3), and the two are clearly inter-related.

3.14 Whatever the details of the calculations, the resulting mismatching reserve is, of course, a minimum figure. The figure actually published must also satisfy the professional judgement of the actuary, including ensuring compliance with Regulation 54.

4. IMPLICATIONS OF THE WORKING RULE FOR HYPOTHETICAL ASSET AND LIABILITY COMBINATIONS

4.1 In this section, a number of hypothetical situations are considered in which assets of one particular type are regarded as ‘matching’ liabilities for contracts of one particular type. The types of asset considered are equities (taken to include property), fixed-interest securities, short-term deposits (taken to include variable interest securities, mortgages and loans) and ‘cash’ (taken to include net current assets). The types of contract considered are whole-life assurances, endowment assurances and temporary assurances in the life assurance fund, and immediate annuities and deferred annuities in the pensions business fund. Where appropriate, both single premium and regular premium, and without-profits and with-profits contracts are considered.

4.2 Besides having liabilities in respect of its long-term contracts, a life office will also have various current and contingent liabilities which would be included within Form 14 of the DTI return. These will either be ‘fixed’ in the sense that they will not vary with investment conditions (e.g. outstanding claims, commission) or ‘variable’ (e.g. provisions for contingent tax on capital gains). For completeness, two further categories of liability are thus considered, namely ‘fixed’ liabilities and ‘capital gains tax’ liability. As well as covering current liabilities, ‘fixed liabilities’ might also be a suitable classification for liabilities in respect of some types of deposit administration contracts – this will depend on the precise terms of the contracts.

4.3 An alternative approach to the treatment of the provision for contingent tax on capital gains would be to apportion this provision to the individual equity and property holdings. In assessing the effect of a 25% reduction in the market value of equities and properties, the consequent reduction in the provision required for contingent tax on capital gains would be taken into account and the

market value (net of contingent tax provision) would reduce by less than 25%. While this alternative method might in some cases be of practical use to an office, the first method outlined above has been used for this exercise.

4.4 In the case of equities or property, under the working rule assets currently of value A would reduce in value to 0.75A while a dividend yield of $i\%$ would increase to $(4i/3)\%$. The yield taken into account must not exceed the yield on $2\frac{1}{2}\%$ Consols. This limit is most likely to have an effect (if at all) in the '– 3%, – 25%' test. For this investigation alternative current equity yields of 3% and 6% are considered. It is noted in passing that the yield shown in Form 45 of the DTI return for equities is effectively a rate convertible half-yearly since it is obtained by dividing the expected income for the following year by the current asset value, whereas the yield for fixed-interest securities is a gross redemption yield (i.e. convertible yearly).

4.5 In the case of fixed-interest securities, under the working rule assets currently yielding $i\%$ would yield $(i + 3)\%$ or $(i - 3)\%$. The effect on asset values would depend on both the coupon and the outstanding term of the stock. The table below shows for fixed-interest stocks redeemable at 100 with coupons 5%, 10% and 15% and outstanding terms 5, 10, 15, 20 and 25 years the values assuming gross redemption yields of 7%, 10% and 13%. Columns (6) and (7) of the table show the reduction in asset values when moving from a yield of 7% to 10% and from 10% to 13% respectively.

(1) Coupon	(2) Outstanding term	(3) 7% value	(4) 10% value	(5) 13% value	(6) Ratio of (4) to (3) %	(7) Ratio of (5) to (4) %
5%	5	92.15	81.51	72.42	88	89
5%	10	86.56	70.03	57.44	81	82
5%	15	82.57	62.90	49.32	76	78
5%	20	79.72	58.47	44.91	73	77
5%	25	77.70	55.72	42.51	72	76
10%	5	113.01	100.93	90.56	89	90
10%	10	122.28	101.50	85.43	83	84
10%	15	128.89	101.86	82.65	79	81
10%	20	133.60	102.08	81.14	76	79
10%	25	136.97	102.22	80.32	75	79
15%	5	133.86	120.34	108.70	90	90
15%	10	158.00	132.97	113.42	84	85
15%	15	175.21	140.81	115.98	80	82
15%	20	187.49	145.68	117.37	77	81
15%	25	196.24	148.71	118.12	76	79

4.6 It will be noticed that the outstanding term is a more significant variable than the coupon (and that this is consistent with the requirement for an analysis by outstanding term in Form 46 of the DTI return). In view of this a single coupon has been used in the calculated examples, with 10% chosen because life offices typically tend not to purchase low-coupon stocks. Stocks of outstanding terms 5, 10 and 25 years are used in our investigations.

4.7 Regulation 59 of the 1981 Regulations requires that the rate of interest used for valuing liabilities should not exceed $92\frac{1}{2}\%$ of the yield currently applying to the appropriate assets. The Regulations further require that for investments to be made more than 3 years after the valuation date the valuation rate of interest must not exceed 7.2% gross. However, as explained in Appendix 6, this restriction is not wholly compatible with the modified net premium method (' W_3 ') used and has accordingly not been rigidly adhered to in our investigations.

4.8 At the time of writing, the life office tax rate for unfranked income is 35% and for franked income is 25%. Tax rates in the future can only be a matter for speculation. Although the recent trend has been downwards, it has been considered reasonable to adopt a uniform rate of 35%. This leads to a maximum re-investment rate (after 3 years) of 4.68% 'net' for life fund contracts.

4.9 Besides having to establish mathematical reserves for its long-term contracts, a life office has to hold assets sufficient to cover its solvency margin. Just as any change in the value of equity or property values affects the attendant contingent capital gains tax provision, so any change in the amount of the mathematical reserves resulting from a change in investment conditions affects the amount of the attendant solvency margin. It is generally considered that provision for solvency margins in the changed conditions is not intended to be part of the working rule. However, for the purpose of this exercise, a rigorous approach has been adopted. Although it is normally a second-order consideration except in the case of temporary assurances, the change in the amount of the solvency margin has been taken into account in the calculation of the mismatching reserve.

4.10 In the case of pension fund and general annuity fund contracts, reductions in liabilities can result in an increase in the liability to Case VI tax on profits. There could in practice be other 'knock on' effects on the tax computation. Any such effects have been disregarded.

4.11 In assessing the amount of mismatching reserve, an assumption has to be made as to the nature of the assets underlying the reserve. The assumption made in Section 3 is that an office will allocate assets to liabilities in descending order of yield with the result that the assets available for the mismatching reserve and free assets would be the lowest yielding assets (most likely equities or property). However, for the purpose of this exercise it has been assumed that the assets underlying the mismatching reserve are of the same type as those underlying the basic liabilities.

4.12 The amounts of the mismatching reserves for a range of hypothetical asset and liability combinations are shown in the tables in Appendix 7.

4.13 Mortality tables used are A67/70 ultimate for assurances and $a(90)$ ultimate for annuities. Liabilities are, where appropriate, valued on the modified Zillmerised net premium method described in Appendix 6. A bonus rate of 5% p.a. compound is assumed for the whole-life and endowment assurance contracts and of 7% p.a. compound for the deferred annuity contract.

4.14 While the practical method of applying the working rule described in

Section 3 is likely to lead to minimum mathematical and mismatching reserves, for certain categories of liabilities the assets allocated might be unsuitable having regard to the type of liability and expected amounts of benefits to be paid under the relevant contracts. However, as discussed in §2.3 we do not see that as an issue. The wider matter which is mentioned in §3.11 should, however, be considered. That is, whether the mismatching reserves would enable the actuary to establish office valuation reserves in the changed conditions which he would regard as adequate.

4.15 Such considerations are particularly relevant to with-profits contracts where, for example, investment in high-yielding fixed-interest securities is unlikely to be the actual investment strategy adopted by the office for these contracts. Nor would a valuation using the resulting yields be likely to produce reserves which the actuary would be able to certify as adequate having regard to Regulation 54. This leads to the vexed question of the 'reasonable expectations of policyholders' (section 37(2) of the Act) and the extent to which allowance ought to be made for future bonuses when assessing the amount of the liabilities.

4.16 In a report presented to the Faculty of Actuaries in 1984⁽³⁾ the Faculty Working Party on the 'Solvency of Life Assurance Companies' commented as follows:

"2.3.2. It does not seem to us reasonable for policyholders to expect that the current level of bonuses declared by the company concerned should be maintained throughout the rest of the term of their policies, let alone increased. Nor, therefore, does it seem reasonable for prospective policyholders to expect that illustrations given at the time they effect policies should necessarily be fulfilled in practice. On the other hand, it is scarcely reasonable to assume, either for current or immediately prospective policyholders, that no bonus whatever should be payable.

2.3.3. It may be thought a reasonable compromise that with-profit policyholders could expect at least the level of bonus in future which would be earned by the bonus loadings inherent in their premiums were the expenses, investment and mortality assumptions underlying the non-profit premiums chargeable by the company concerned to be experienced in future. This level of bonus might well for a typical U.K. with-profit company be something like one half of current bonus levels and we, therefore, suggest that reversionary bonuses at this level could probably be considered a reasonable expectation for participating policyholders."

4.17 If this view is accepted, the conclusion would follow that reserves would be unsatisfactory if they were insufficient to enable bonuses to be paid in future at a level appropriate to the changed investment conditions. For example, an increase of 3% in fixed interest yields would be unlikely in practice to result in a reduction in reversionary bonuses – just the opposite – and consequently reserves which were sufficient only to support reversionary bonuses at a reduced level would be unsatisfactory. Although reserves would be calculated on a net

premium method. their adequacy would of course be tested using a bonus reserve method. This approach would need to be followed through to the mismatching calculations.

4.18 The contrary view would be that the test is purely one of solvency in the changed conditions and that future bonus prospects do not have to be taken into account. In that case one is only concerned with reserves on the statutory minimum bases. This is the approach adopted for this exercise, but that should not be taken as an endorsement of the approach.

4.19 Terminal bonuses are now a common feature within the bonus structure of offices transacting with-profits business, but practice varies as regards reserving bases. Most offices make no explicit allowances within reserves, some hold an additional reserve equal to the expected cost of terminal bonuses for the following year only, whereas others set aside more substantial reserves to meet the accrued cost of terminal bonuses. If reserves in respect of terminal bonus are established, then that approach has mismatching advantages. If equity values reduce by 25% but fixed interest yields remain unchanged, the likely reaction of an office would be to reduce terminal bonus rates but to leave reversionary bonus rates unchanged. Lower terminal bonuses would naturally result in lower reserves being required for terminal bonuses. In other words, any reserve for terminal bonus can play a further role as a mismatching reserve to cover a reduction in equity or property market values. That effect is not surprising since the office reserves are, of course, higher than would be the case if no reserve for terminal bonuses was held.

5. USE OF STOCHASTIC METHODS TO ASSESS THE EFFECTIVENESS OF THE WORKING RULE

5.1 The objective in this section is to consider the reasonableness or otherwise of the working rule and whether the profession should recommend any modifications to it, or any alternative (or additional) standards. The reasonableness of the benchmark approach is considered in relation to matching on a cash flow basis, comparing asset proceeds with liability outgo. Tests have been carried out on some of the non-profit examples considered in Section 4. No tests have been carried out on with-profits business in view of the complications which arise in devising an algorithm for determining the bonus rates from year to year for each trial. It is felt that the results for non-profit business should provide a reasonable guide to the effectiveness of the working rule. In the investigation 'solvency' is taken to have its colloquial sense - that is, the matter of the point at which the authorities would intervene in practice is not considered.

5.2 In order to carry out a cash flow projection, assumptions are required as to future financial conditions. The approach adopted below is to use a stochastic model whereby a large number of trials are carried out, each producing a set of future values for the Retail Prices Index, the yield on fixed interest stocks and deposits (assumed to be uniform at any point of time), equity prices and equity dividend yields. The outcome of each trial is considered equally likely (or

unlikely!) to occur in practice. The adequacy of the assets backing the liabilities is assessed by carrying out a cash flow projection using the results of each trial. By carrying out a suitably large number of trials the probability that the assets are adequate can be determined.

5.3 The stochastic model chosen for the purpose is that developed by Mr A.D. Wilkie⁽⁴⁾. The parameters adopted are based on Wilkie's 'Full Standard Basis' which includes initial values as follows:

Rate of inflation	5% p.a.
Dividend yield	4% p.a.
Yield on consols (used for fixed interest stocks and deposits)	8½% p.a.

but different yield figures have been substituted according to the scenario under test. The rate of tax on income has been taken as 35%; tax on capital gains has been ignored. Any method of determining probabilities relating to zones of the funnel of doubt must be used with reservation particularly if attention is being paid to the outer regions. The reliability of the answers brought out by using a model can be only as good as the assumptions underlying that model: however the Working Party considers Wilkie's model suitable for the purpose of this investigation.

5.4 In carrying out the projections, the income comprised:

- Premiums (gross office premiums)
- Investment income (net of tax)
- Redemptions of fixed interest stocks

and outgo comprised:

- Death claims
- Maturities
- Expenses (net of tax relief).

When outgo exceeded income, disinvestment was necessary; this was carried out in the order:

- Cash and deposits
- Redeemable securities (shortest terms first)
- Irredeemable securities
- Equities.

If income exceeded outgo new investment could have been made and this is considered in §§ 5.9 and 5.10.

5.5 For the purpose of the calculations various assumptions have been made. It should not be construed that the Working Party necessarily regards all these assumptions to be appropriate to the circumstances of a typical life office. The assumptions used were as follows:

- (i) The mortality table used was A1967-70 Ultimate. It could be argued that in a stochastic model deaths should be deemed to occur according to an

appropriate statistical distribution. As it is the effect of the investment conditions in which we are interested it was considered acceptable to treat mortality deterministically.

- (ii) Expenses for endowment assurances and whole life assurances were taken at the rate of £9 p.a. per policy (before deducting tax relief) at the valuation date increasing in line with the projected RPI figures for the trial.
- (iii) In order to avoid further complications in the model, no provision for withdrawals has been made. It might, in any case, be argued that provision for withdrawals is not necessary as no account of these is taken in the valuation (subject to the reserves being adequate to cover surrender values).

5.6 In determining each net premium when calculating the valuation reserves, the only modification to the pure net premium which has been made is to restrict it to 95% of the office premium. This contrasts with the calculations described in Section 4 and in Appendix 6; there, the ' W_3 ' modification has been made and a Zillmer adjustment has been introduced. Consequently those figures are not strictly comparable to the results of this section.

5.7 Paragraph 5.2 refers to the probability that the assets were adequate. We shall use the term 'probability of ruin' to denote the proportion of trials where the holding of assets is exhausted before the liabilities have run off. Other approaches are, of course, possible - e.g. looking at the distribution of the time before the assets are exhausted or the probability that they are exhausted within a specified number of years. However, it is desirable to be evenhanded between offices with long and short term liabilities.

5.8 The interpretation of a 1% probability of ruin is not necessarily that 1 in 100 offices will fall by the wayside before existing liabilities run off; since all offices are subject to the same external economic conditions it could mean that there is a 1 in 100 chance that many offices will become insolvent! To obtain the probability of ruin a large number of trials is required. The results below have been based on 10,000 trials where the assets include equities and 5000 trials otherwise. Even so, it is evident that a greater number of trials is necessary to make the results shown in the tables in Appendix 8 accurate to the number of significant figures shown.

5.9 There are many different assumptions one could make when investment is to be made at a future point of time. These include:

- (i) Investment in a manner having regard to the remaining liabilities - i.e. assume that the investment manager has regard to cash flow matching or to immunisation;
- (ii) Investment in the same securities as are already held;
- (iii) Investment in cash on deposit.

The first of these would be difficult to program. In any event if there is to be cash flow matching or immunisation in the future one might just as well reorganize the current portfolio at the start. This would be tantamount to having no regard whatever to the existing assets.

5.10 Some trials were carried out using methods 5.9 (ii) and 5.9 (iii). The probabilities of ruin were generally greater and more widely dispersed with method (ii) than method (iii). This is probably because the fortunes of investments in other than cash are dispersed more widely about the mean. Bearing in mind that only without profits business is being investigated, investment in cash has been adopted. This is a stringent approach since, in practice, the investments may be managed in a manner which would reduce the probability of ruin.

5.11 One way to tackle the investigation would be to decide what probability of ruin to regard as acceptable and then to determine what holding of the particular type(s) of asset being considered is needed to bring the probability of ruin down to the selected level. One could then determine a rule (such as $\pm 3\%$, $\pm 25\%$) to approximate to this. The first problem is fixing an acceptable figure for the probability of ruin. The recommendations in the Report of the Maturity Guarantees Working Party⁽⁵⁾ feature a probability of ruin of 1%. In considering the suitability of a particular level it must be remembered that margins have been introduced – the stringency of the future investment assumptions (see §§ 5.9–5.10), the assumption that there are no withdrawals, and the cushion provided by any with-profits business where the bonus rates could take the strain. More relevant is the fact that we are considering a single asset against a single liability; the risks associated with a portfolio of assets backing a portfolio of varied liabilities will generally be much smaller than the risks attaching to subsets of the portfolios taken in isolation. This is considered further later.

5.12 It is not possible to input a probability and derive the asset value without recourse to an iterative method where various asset values are used for the starting points and one successively homes in on the required answer. In our work, no attempt was made to 'solve' for the desired asset value; only asset values based on the working rule were used.

5.13 The statutory minimum valuation basis requires a $7\frac{1}{2}\%$ margin on the asset yield and an assumed maximum reinvestment rate of 7.2% p.a. (the three year period has been ignored for convenience in the calculations carried out in this section). It can be argued that both of these margins are to cover contingencies which the provision of a mismatching reserve is intended to cover. Trials have been carried out with and without those margins being included. The solvency margin has been ignored.

5.14 Calculations have been carried out for non-profit endowment assurances (where a sum assured of £5,000 has been assumed) and for non-profit whole life assurances (for which a sum assured of £10,000 has been assumed) backed by a range of different types of investment as in Section 4. The results are shown in Tables 8.1 - 8.9 in Appendix 8.

5.15 The following amplifies the descriptions in the headings to the tables:
Columns (1) and (2) - These give details of the asset assumed to be backing the liabilities and are as in Section 4.

Column (3) - This is the yield assumed to be available on the asset at the valuation date.

Column (4) - For the purpose of calculating mismatching reserves a sudden change to this yield is assumed. In the case of equities, this is a consequence of a 25% change in market value, assuming that the income remains unchanged.

Column (5) - It is assumed that assets are held of value equal to the liabilities determined using a rate of interest, net of tax, based on $92\frac{1}{2}\%$ of the yield shown in column (3) and subject to a maximum of 7.2% p.a. Trials are then carried out as described in the preceding paragraphs and the resulting probability of ruin is shown in column (5).

Column (6) - If the yield were to change immediately after the valuation date to that shown in column (4) from that shown in column (3), the holding of assets at the valuation date would need to be changed (generally increased) to an amount before the change in yield such that after the change in yield it would become equal to the liabilities determined using a rate of interest, net of tax, based on $92\frac{1}{2}\%$ of the yield shown in column (4) and subject to a maximum of 7.2% p.a. Column (6) shows the percentage increase in the holding of assets at the valuation date resulting from this change.

Column (7) - Trials are carried out assuming this increased holding of assets and the resultant probability of ruin is shown in column (7). Exceptionally, where the holding of assets does not increase, no figures are shown in columns (6) or (7). Current financial conditions are assumed at the start of each trial.

Columns (8) and (9) - In determining the amount of assets needed for the purposes of columns (6) and (7) the valuation rate of interest was derived subject to the $92\frac{1}{2}\%$ and 7.2% p.a. limitations. For the purposes of columns (8) and (9) these limitations have been disregarded. However, in some instances the holding of assets decreases from that derived as in the description above for column (5) and in such cases no figures are shown.

5.16 Most of the probabilities of ruin shown in columns (7) and (9) of the tables may be regarded as acceptably low although some are rather higher and in a real situation could give rise to concern. However, there are many instances where the figures in columns (7) and (9) are lower than any standard likely to be set in practice, indicating that the additional reserves demanded by the working rule are more than really necessary; indeed there are many instances where column (7) is little smaller than column (9) indicating that the additional assets required do not give a significant improvement in the probability of ruin. The conclusion is that for many of the combinations of asset and liability the need to meet the ($\pm 3\%$, $\pm 25\%$) test and at the same time satisfy the statutory limitations on the valuation rate of interest is too strong while for some of the combinations the test is too weak.

5.17 It was mentioned in § 5.11 that risks associated with portfolios of business should be smaller than those for single specimen policies. Some further tests have been carried out for a portfolio of non-profit endowment assurances and whole life assurances and the results are shown in Table 8.10. The portfolio used

consisted of endowment assurances of term twenty years without profits with maturity dates spread over the first twenty years together with some whole life assurances without profits effected by a 30-year-old and now at various durations. The liability outgo was substantially heavier in the first twenty years than subsequently.

5.18 The results in Table 8.10 do not present any real surprises. All the figures in column (7) are low except those for equities. It is interesting to note from the fourth line of the table that for a short term fixed interest stock the limitations on the valuation rate of interest represented by columns (8) and (9) do provide a necessary margin. For the longer term stocks, it is evident that the margins are unnecessary.

5.19 It would obviously be possible to extend the tests to other classes of business and other combinations of assets and liabilities. It would also be possible to use the method to test variants of the working rule. For instance, one could consider rules such as those discussed in §§ 2.6–2.7. The Working Party feels that there is not sufficient pattern in the results being produced for it to become clear that one type of rule is preferable to another.

6. REFLECTIONS ON RESILIENCE

6.1 The bulk of this paper comprises a detailed factual investigation of the current working rule, and suggests ways in which it can be applied in practice. In summarizing the main conclusions reached in our work, it may also be appropriate to stand back from the detail and address some of the more fundamental underlying issues, in the hope that our views on these will help to focus the discussion on principles rather than detail.

6.2 Although the working rule is, at first sight, a straightforward mechanistic operation, in practice there are a number of ambiguities in precisely how it should be applied. A number of those are described in Section 2 and suggestions are made for the logical development of the rule as necessary.

6.3 Despite the ambiguities described above, in general the working rule is not difficult to apply in practice. A helpful way of organising the work with a practical methodology is given in Section 3.

6.4 Sections 4 and 5 are in many ways the heart of the paper. A number of hypothetical simple portfolios are examined as a first step towards answering the question ‘does the working rule produce logical results in practice?’. The results of Section 4 show a somewhat mixed picture. Looking, for example, at the results for a without-profits endowment assurance of remaining term 5 years the lowest mismatching reserve arises when the outstanding term of the matching fixed interest stock is also 5 years. That seems a logical position. However, it is less clear that it is appropriate to require a higher mismatching reserve for equities backing a with-profit endowment assurance than if the same assets are backing a comparable without-profits policy, although that feature appears to be due to the effect of the net premium valuation method. A number of other similar observations can be made.

6.5 Some illogicality of effect is only to be expected in such a simple rule and the results in Sections 4 and 5 should not be regarded as surprising. In general, the test exhibits reasonable consistency of effect where the match is one which is intuitively sensible, but is less satisfactory where there are more unusual combinations of asset and liability. Despite that drawback, we conclude that the working rule test is as satisfactory as any other simple test is likely to be. However, we recommend that consideration be given to modifying the test in conditions which are, historically, extreme along the lines suggested in §§ 2.6 and 2.7.

6.6 Turning to the wider issues, the first relates to the strength of the resilience test that should be applied as a 'standard'. It is intuitively clear (and is confirmed by the work already presented in this paper) that no test can be equally stringent for all offices, or at all times - and nor indeed should it be. More appropriate, perhaps, is to consider the 'objective' severity of the test, in the sense of the likelihood of the described fluctuations actually occurring within a fairly short period (months rather than years). It is our view that a test based on detailed statistical analysis is out of place in this particular discussion: the precise test is, ultimately, arbitrary and a broad measure of severity is all that is required.

6.7 In § 2.9 of our earlier paper, reproduced in Appendix 2, we concluded that the current working rule described market fluctuations that might be expected every decade or so. This view has not altered. As such we believe that the test represents a reasonable minimum standard of severity, which companies should be able to meet without difficulty unless economic circumstances are extreme. There seems to be no overwhelming justification for insisting that a significantly more severe objective test should be imposed as a matter of course, though we accept that the GAD is reasonably entitled to ask Appointed Actuaries for further comments on their companies' mismatching position where this seems necessary. While such enquiries could extend to more severe tests than the working rule imposes, this should be (as indicated in the Government Actuary's 1985 memorandum) in the context of cash flow mismatching and a gross premium valuation. The artificialities and constraints of the net premium valuation required by the current regulations render any test more severe than the current one inappropriate, in our view.

6.8 A particular component of the strength of the resilience test occurs in the discussion on yield and earnings effects. These were considered in §§ 2.7 and 5.9 of our earlier paper, and we do not wish to add to those comments; we would merely reiterate that the '7½% of yield' margin should be subsumed into the resilience test rather than maintained as a further requirement, with the consequential arbitrary inequity between offices.

6.9 In §§ 2.6 and 2.7 of the current paper we have put forward proposals for refinement of the working rule to make allowance for adverse circumstances. There is clearly an argument which says that when conditions are particularly 'favourable', as for example they appeared to be in early 1972 and mid 1987 (see Appendix 3), a stronger test should be required. For the reasons already

adumbrated, however, we do not see a need for greater severity as a matter of course, and would be uneasy at any formal requirement for a stronger test at certain times. We prefer to believe that the actuary would have due regard to economic conditions when he determines whether the standard test is adequate for any particular valuation.

6.10 Similar reasoning can be applied to the issue of 'coherence' which we addressed briefly in § 2.8 of our earlier paper (see Appendix 2). Common sense tells us that, as with any other requirement that has the effect of incorporating a margin, it is quite inappropriate to impute any sort of iteration into the resilience test. If substantial changes in values are known to have taken place just after the valuation date, this fact could hardly be overlooked by the actuary in determining his reserves. Changes before the valuation date, as occurred in October 1987, would also have no effect on the need for, or strength of, a resilience test unless the post-change conditions were considered to be exceptional: in this, by definition unusual, event it might well become necessary to modify valuation requirements in a context wider than merely resilience. We will not attempt to define 'exceptional' except by suggesting that conditions were *not* exceptional at the end of 1987, but *were* at the end of 1974!

6.11 A topic of considerable importance, to which we are conscious we have done less than full justice, is the treatment of with-profits business. As indicated in §§ 4.15–4.17 the application of resilience tests is inextricably bound up with the interpretation of 'reasonable expectations' and the assessment of bonuses that would be paid in changed conditions. The topic is one that is currently the subject of major debate and much research within the profession, and we make no apology for failing to add significantly to the published material. Suffice it to say that the resilience test should follow, rather than lead, professional thinking on this issue, and at a practical level we would not envisage much difficulty in modifying or refining the test to incorporate the results of that wider research.

6.12 Finally we turn to the issue of consequential action. The questions were succinctly expressed, in the form of examples, by Roger Corley in his Presidential Address on 24 October 1988⁽⁶⁾. He asked, 'If the market shifts in such a way as to remove 90% of a particular life office's mismatching reserve, and there is no reason to expect a reversal, what mismatching reserve should that office then be required to maintain?', and 'If an early warning bell sounds, what action is required of the Appointed Actuary?'. We are clearly here considering, not the exceptional conditions affecting all offices referred to in § 6.10, but difficulties for an individual company which might correspond to level (ii) of the three situations described in § 1.15 of Sir Edward Johnston's November 1988 paper⁽⁷⁾. The outline of remedial action (though not related specifically to resilience issues) described in that paper will repay careful study. It could hardly be appropriate for a failure to meet the mismatching test *in itself* to lead to a section 11 Order, for surely the purpose of the reserve is to give time for corrective action to be taken, not to cripple companies unnecessarily. It clearly *would* be appropriate,

if the hypothetical company in Roger Corley's first question could no longer support the normal mismatching reserve, for the DTI and the GAD to seek a clear and formal plan from the company's management to attempt to rectify things over a reasonably short timescale. There are indeed major issues here, of great importance to the profession, and we support the call for a central group to consider the questions fully.

6.13 In conclusion, we would return to the central topic of this paper and reiterate the over-riding principle that the working rule is only a tool which the actuary may find helpful in using his professional judgement in relation to the situation of his own office. The GAD has indicated that it does not regard tests based solely on the working rule as necessarily sufficient. That neatly illustrates the fact that the actuary's own judgment is of paramount importance.

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APPENDIX 1

MEMORANDUM TO APPOINTED ACTUARIES
FROM THE GOVERNMENT ACTUARY

VALUATION RETURNS IN RELATION TO SOLVENCY MARGINS

1. It is apparent from my Department's scrutiny of companies' 1984 returns that many actuaries have not appreciated the full impact of the changes in the Accounts and Statements Regulations which came into force in March 1984 to give effect to the solvency margin requirements. Many companies have received letters drawing attention to aspects of their 1984 returns which do not appear to meet the new requirements, and the DTI with GAD is considering these on a company by company basis. Many of the points which are causing difficulty are in fact mentioned in the guidance notes on the preparation of annual returns issued by DTI in September 1984. My purpose in writing to you, in common with all other Appointed Actuaries to U.K. authorised companies, is to draw your attention to these guidance notes and also to explain rather more fully the background to and the nature of the changes in the regulations. I hope that any misunderstandings can be cleared up in time for the preparation of the next set of returns, which for most companies will be as at 31 December 1985.
2. The problems seem to arise from the interaction of several factors:
 - (i) The solvency margin requirement itself which means that a clear distinction must be drawn between the actuary's reserves and any free reserves in the life fund available for solvency margin.
 - (ii) The market value basis laid down for the valuation of assets. The balance sheet and statement of solvency in the Accounts and Statements Regulations are constructed around this concept.
 - (iii) Many companies prefer to maintain their life assurance funds at book value, rather than writing the fund up or down to market value each year. It is not intended to whittle away this facility, but there is no doubt that it adds to the complications.
3. The valuation regulations require actuarial reserves to be calculated on a prudent basis. Regulation 55 covers mismatching reserves, which ensure that the company can continue to maintain reserves meeting the minimum criteria in the face of changing investment conditions.
4. Although, in Schedule 4, an actuary may set his reserves in the context of the book value of the life assurance fund, for the purposes of the balance sheet and the statement of solvency (Forms 9, 10 and 14) the reserves have to be set in the context of the assets broadly at market value, as required by the asset valuation regulations. In other words the Schedule 4 valuation has to be justifiable by reference to market values, or additional reserves will need to be set up. In concept there are two sets of mathematical reserves, relating to book and market values respectively. Only the excess over the

total market' reserves, which have to be sufficient to cover all foreseeable liabilities including contingencies arising from mismatching, can be counted towards the solvency margin. In practice the main elements of a 'book' valuation basis, such as interest and mortality, are likely to be appropriate for both valuations, but additional provision may be needed for, e.g. mismatching or capital gains tax liabilities, in order to move from a 'book' to a 'market' basis. If any of these items have been set against the margin between market and book values of assets, it is necessary to know how much of this margin has been so used, as only the remainder can count towards the solvency margin. This addition to the Schedule 4 mathematical reserves has to be mentioned in the Actuary's Certificate and shown in a note to Form 14.

5. Thus, in order that GAD can examine valuations in the usual way, the nature and extent of the provision for mismatching and CGT liabilities needs to be stated in the Fourth Schedule. Only then can a view be taken about the cover for the solvency margin shown in the returns. This is the background to paragraphs 7.7.6 - 7.7.7 and 12.6 - 12.8 of the DTI guidance notes.
6. Neither the valuation regulations nor the Institute and Faculty guidance notes lay down a specific basis for the calculation of mismatching reserves, so this is left to the professional judgement of the actuary. GAD's function is to advise the DTI how each company stands having regard to the DTI's responsibilities under the Act. While GAD applies its professional judgement in formulating such advice, we need some rule against which to assess the adequacy of mismatching reserves. Obviously this becomes more crucial the smaller is the excess of free assets over the required solvency margin, but it would be untenable for DTI to operate the regulations on the basis that specific mismatching reserves need to be set up only where the cover for the solvency margin is low, but that stronger companies need not bother and may thus overstate the cover for their solvency margins.
7. In general it is GAD's longstanding practice to formulate its own internal working rules after looking at the way in which established companies have treated the question, which thus needs to be set out in their Fourth Schedules, and after considering any Institute, Faculty or other papers on the subject and discussions thereon.
8. As regards mismatching reserves, the present working rule has regard to current investment conditions and to the tempo and scale of past changes. The present rule was stated at the Birmingham Convention; very briefly we would compare the company's reserves with the ability to meet the requirements of the Regulations (other than Regulation 55) given an immediate rise or fall of 3% in the rate of interest and fall of 25% in equity prices.
9. Naturally companies should also look at their mismatching provisions on the basis of cash flow matching, over a wide range of investment conditions, but this would be in the context of a gross premium valuation rather than

the net premium valuation required by the regulations. These tests need not be fully described in the Fourth Schedule as a matter of routine, the amount of information to be shown would depend on their significance for the company concerned.

10. The essential point, however, is that Fourth Schedule returns will in future need to give greater detail as to the manner of assessment of mismatching reserves and provision for Capital Gains Tax.
11. Before the valuation regulations and guidance notes were written, there were extensive discussions in the Joint Actuarial Working Party comprising representatives of DTI, GAD and the Institute and Faculty. It is now intended to reconvene the Group to consider problems arising. This note is not intended to pre-empt the Joint Working Party in any way. I am writing to you now because it seems necessary to clarify as soon as possible what we will be looking for in the forthcoming returns. I hope this will be helpful.

13 November 1985

APPENDIX 2

EXTRACT FROM 'PROPOSALS FOR THE STATUTORY BASIS OF
VALUATION OF THE LIABILITIES OF LINKED LONG-TERM
INSURANCE BUSINESS'

2.6 The rise or fall in gilt yields of 3% is unambiguous, since the dividend flows on a gilt are guaranteed. The meaning of a 25% fall in value for equities and properties is less clear: should one assume a rise in yields, a fall in earnings, or some combination of the two? At the end of TPN2 it is indicated that a rise in yields may be assumed when applying the current test, the earnings being unaffected. However, as a basis for the later development of mismatching reserves for linked business, it is helpful to consider equity price falls in a little more detail.

2.7 *Yield and Earnings Effects*

2.7.1 The discussion in this paragraph is based on the simple model of $\text{Price} = \text{Earnings/Yield}$ (where Earnings refers to Dividends or Rents as appropriate) used in the Maturity Guarantees Working Party report. Other, more complex, models have been constructed, but the simple model has already found reasonable acceptance and is sufficient to illustrate the influences involved.

2.7.2 The market yield changes from day to day and can move quickly. However, it is not unreasonable to model the yield as if it has an underlying long-term level around which the actual yield at any point in time fluctuates. The further the actual yield is from the long-term level, the more likely it is to move back towards it. This is the approach adopted by the Maturity Guarantees Working Party, of course, and it accords with practical intuition.

2.7.3 Earnings change more slowly. Over time they have normally shown growth, but can reduce. Once a reduction occurs, it is less likely to be a short-term feature. Indeed a fall in earnings for any individual equity may well be the harbinger of further bad news. Thus, earnings changes are more 'permanent' – there is no 'long-term' level as there may be for yields. Again, this represents the approach adopted by the Maturity Guarantees Working Party.

2.7.4 From these considerations it is clear that a fall in value resulting from a fall in earnings should be regarded as having a longer term effect on asset income and asset values, whereas a fall in value caused by a rise in yield has no effect on asset income. The effect of a yield rise on asset values may or may not be long-term, depending upon where the yield after the change stands relative to the long-term yield level, but whatever the case, the yield rate has risen. Of the two changes, it is immediately clear that the fall in earnings is the more serious problem.

2.7.5 An important corollary to this is that the current – 25% mismatching test is at the weak end of its possible range, operating as it does via yield and leaving earnings unchanged. However, in his remarks at the Birmingham Convention Mr C.L. Cannon indicated that more extreme asset movements should also be tested. Giving $\pm 5\%/-40\%$ as an example, he mentioned that at that

stage an actuary might reasonably have recourse to the margins contained in the minimum standards under Regulations 56 to 64 (and make provision for only a modest level of bonuses), whilst for even more extreme changes in conditions the actuary could rely on the explicit solvency margin in addition to margins in the reserves.

2.8 Coherence

2.8.1 Another area of some difficulty relates to problems of coherence. Should the test be modified if substantial changes in values have occurred just *before* the valuation date (or are known to have occurred just *after* it)? In testing for resilience to the assumed benchmark changes, must the actuary assume a succession of such changes into the future?

2.8.2 In fact the answer to the second question above, as indicated in paragraph 8 of the Government Actuary's memorandum (Appendix 1) is 'no' – to the relief, no doubt, of actuaries generally. On the more general issue it should perhaps be noted here that the *current* test is not regarded as a 'scenario test' and it is not intended that it should become so. In other words, it does not represent a hypothesis about future economic events, but is a purely mechanical process for testing that Regulation 55 can be met. Thus, for example, recent movements in value are ignored. Other parameters are set to maintain the same 'severity' of test compared with the situation before the fall. However, as with yield and earnings effects, it may be helpful to consider coherence problems, from a more theoretical standpoint, in a little more detail.

2.8.3 Any mismatching test will, of course, be subject to some coherence problems. The objective should be to leave in the test the coherence risk which is actually present in real life and to reduce to a minimum any which is created artificially by the test.

2.8.4 Providing that the part of the test dealing with the possibility of an earnings fall is of reasonable weight, there should be no artificial coherence problem from this source. That is, if earnings have fallen just prior to the valuation, it is fully correct that the mismatching test in the valuation examine a further fall. As argued above, when earnings go down they are likely to have moved to a lower path more permanently. A further fall is not improbable.

2.8.5 Moving to look at the yield situation, an office's management will presumably monitor matching continuously, via immunization analyses and so on. Significant market movement should trigger readjustments to the matching position in appropriate areas - for example, a gilt portfolio may be restructured to re-base an immunization. To some extent then, the coherence problems may be reduced by timely management action. Nevertheless, where substantial movements occur very close to the valuation date and for asset holdings not driven by guarantee considerations, there will remain the problem of whether a further yield rise is likely and by how much.

2.8.6 One way to deal with this would be to establish a more flexible test in which the yield risk to be examined varies in extent according to the relationship

of the yield on the valuation date with the long-term yield. A table might be used in which the higher the actual yields stand, the lower the additional asset weakening from further yield increase which must be tested. This would require further investigative statistical work, but should be achievable. The initial work could also establish what the long-term yield should be taken to be for equities and properties independently. The long-term yield should also be subject to periodic review. Perhaps every fifth year might be a sufficiently frequent interval for this.

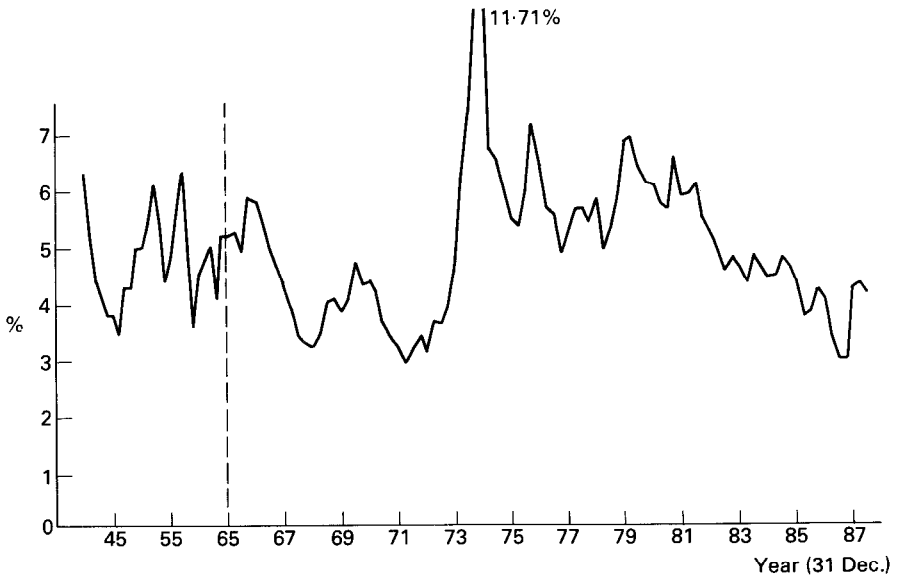
2.9 In concluding this section, we return briefly to the severity of the current working rule. In terms of market fluctuations actually observed, it describes movements which might be expected to occur (over fairly short periods) every decade or so. As such, it is probably perceived by the profession as a reasonable minimum 'external' standard to use in normal circumstances, and one which companies should be able to satisfy without difficulty. Its 'internal' effect is not, of course, equally stringent for all companies, and varies, for example, with the asset mix: for non-linked business the statutory net premium method of valuation can also introduce distortions. It is an open question (which we do not intend to answer here) whether the optimum test *should* be of this order of 'objective' severity, or whether a more stringent test would be desirable.

APPENDIX 3

EQUITY YIELDS (DIVIDENDS)

Sources:

- BZW equity index (end year figures) 1940-65
- FTA All-share (end quarter figures) 1966-88



APPENDIX 4

VALUATION METHODS

1. As mentioned in §2.11, the application of the '7.2% maximum after 3 years' restriction is not wholly consistent with the traditional form of net premium reserve. It is therefore natural to try to find a valuation method which, whilst preserving the essentials of the net premium approach, allows for a rate of interest achievable on future investments which differs from the rate of interest currently being earned.

2. A method of this type which has attracted some interest is known as the ' W_2 ' method. That is a reserving method suggested by one of the current authors, Mr A.E.M. Fine, which allows for two rates of interest but retains the net premium approach. It first received widespread publicity at a Life Assurance Conference held at Gleneagles Hotel in October 1986 and was subsequently discussed in some detail by Mr S.F. Elliott in his paper⁽⁸⁾ presented to the Bristol Actuarial Society in March 1987. This appendix gives a very brief summary of the development of that method for reference purposes. Some brief comments are also given on another suggestion for a suitable valuation method under the regulations.

The W_2 Method

3. Let the traditional net premium reserve, e.g. ${}_tV_{x:\overline{n}|i}$, be denoted ' V_1 '. Then by use of a premium conversion formula it is easily demonstrable that

$$V_1 A_{x+t:\overline{n-t}}^i + \left(\frac{i}{1+i} V_1 + P_{x:\overline{n}}^i \right) \ddot{a}_{x+t:\overline{n-t}}^i = A_{x+t:\overline{n-t}}^i$$

If instead of assuming a level interest rate, i , it is assumed that the current earnings rate is g and the future reinvestment rate will be i , then the analogous reserve to V_1 , known as V_2 , is given by

$$V_2 A_{x+t:\overline{n-t}}^i + \left(\frac{g}{1+i} V_2 + P_{x:\overline{n}}^i \right) \ddot{a}_{x+t:\overline{n-t}}^i = A_{x+t:\overline{n-t}}^i$$

Equating the above two expressions for $A_{x+t:\overline{n-t}}^i$ gives the more usual expression for V_2 .

$$V_2 = \frac{V_1}{1 + \frac{g-i}{1+i} \ddot{a}_{x+t:\overline{n-t}}^i}$$

4. The V_2 method has been examined elsewhere in the literature and has been found to give reserves which do not have satisfactory characteristics in all circumstances. Such deficiencies have led to the development of the W_2 method.

5. The essential difference between the ' V ' and ' W ' methods is that, in the latter, the net premium itself is made dependent upon both i and g . A ' W_1 '

reserve analogous to V_1 is given by the formula

$$W_1 = A_{x+t:n-t}^i - P_{x:n}^{(ig)} \ddot{a}_{x+t:n-t}^i$$

where $P_{x:n}^{(ig)}$ is a net premium calculated on a rate of interest, i' , which is some function of i and g . A simple weighting which has regard to the outstanding term such as

$$i' = \frac{tg + (n - t)i}{n}$$

is normally used. W_1 reserves do not have particularly satisfactory properties and are simply an intermediate step.

6. W_2 reserves are developed from W_1 reserves by a formula analogous to that given in § 3 of this appendix for V_2 . That is

$$W_2 = \frac{W_1}{1 + \frac{g - i}{1 + i} \ddot{a}_{x+t:n-t}^i}$$

A Further Method

7. A different conceptual approach has been suggested by Mr C.S.S. Lyon and is also recorded here for reference. His approach starts from the basic valuation formula (ignoring mortality):

$$V = v^t S (1 - f_r)$$

where f_r represents the proportion of S which can be secured by future premiums. A 'prudent' valuation method will ensure that f_r is not overstated. In the traditional net premium method $f_r = P_{\bar{n}}/P_{\bar{r}}$ where both numerator and denominator are calculated at the valuation rate of interest.

8. The presentation reveals a fundamental problem of the net premium method in that f_r increases as the interest rate falls whereas in a gross premium valuation (or a net premium valuation where the net premium has had to be restricted by reference to the office premium) the opposite is true. That has led to the suggestion that an appropriate valuation method may be to calculate f_r using a formula of the above type at a uniform high rate of interest. One would then discount $S(1 - f_r)$ at a rate of interest which had regard to the current yield on assets at market value and allowed for the effect of future realisations and reinvestments.

9. If it is appropriate to assume that the current yield on the present reserve will be maintained for the duration of the policy, then the method, designated here as ' U_2 ', bears the same relationship to a hypothetical U_1 as V_2 and W_2 bear to V_1 and W_1 respectively. Thus

$$U_1 = A_{x+t:n-t}^i \left[1 - \frac{P_{x:n}^h}{P_{x+t:n-t}^h} \right]$$

and

$$U_2 = \frac{U_1}{1 + \frac{g-i}{1+i} \ddot{a}_{x+t:\overline{n}|i}^i}$$

where h is a suitably large, independently determined rate of interest.

10. It is evident that U_2 is larger than V_2 if $h > i$. It can be shown that U_2 is larger than W_2 when $g < h$ and smaller if $g > h$; they are approximately equal when $g = h$. For a constant h , U_2 reserves are therefore more sensitive to changes in g – and therefore to changes in asset values – than are W_2 reserves. Some disadvantages of the method are apparent, particularly regarding who should be responsible for setting the value of h . The U_2 approach does also move some way away from the pure net premium valuation. However, at the time of writing the approach has not been fully explored.

11. A further specific development of the W_2 approach, which has been used in the investigation in Section 4, is described in Appendix 6.

APPENDIX 5

ILLUSTRATIONS OF THE METHOD DESCRIBED IN SECTION 3

Tables 5.1–5.3: *Illustration ignoring contingent tax on capital gains*Table 5.1. *Apportionment of current assets equal to liabilities*

	<u>Gilts</u>	<u>Land</u>	<u>Equities</u>	<u>TOTALS</u>	<u>Average Yield</u>	<u>92.5%</u>
Yield	11.2%	5.1%	3.6%			
Life assurance fund	267,000	445,000	103,500	815,500	6.91%	6.39%
General annuity fund	3,120	5,200	1,560	9,880	6.79%	6.28%
Pension business fund	28,800	48,000	14,400	91,200	6.79%	6.28%
TOTALS apportioned to liabilities	298,920	498,200	119,460	916,580	6.89%	6.38%
Mismatching reserve derived from Table 5.2	–	–	60,923	60,923		
	298,920	498,200	180,383	977,503		

Table 5.2. *Revised values of apportioned assets and liabilities
in the ‘–25%, +3%’ test condition*

		<u>Gilts</u>	<u>Land</u>	<u>Equities</u>	<u>TOTALS</u>
Yield		14.2%	6.8%	4.8%	
Life assurance fund	Assets	226,950	333,750	77,625	638,325
	Liabilities	226,500	377,500	87,801	691,801
		+ 450	– 43,750	– 10,176	– 53,476
General annuity fund	Assets	2,652	3,900	1,170	7,722
	Liabilities	2,490	4,150	1,245	7,885
		+ 162	– 250	– 75	– 163
Pension business fund	Assets	24,480	36,000	10,800	71,280
	Liabilities	20,000	33,333	10,000	63,333
		+ 4,480	+ 2,667	+ 800	+ 7,947
TOTALS	Assets	254,082	373,650	89,595	717,327
	Liabilities	248,990	414,983	99,046	763,019
		+ 5,092	– 41,333	– 9,451	– 45,692

Assuming the mismatching reserve is held as additional equities, its amount is $45,692/0.75 = \underline{60,923}$

Table 5.3. *Apportionment of assets (including mismatching reserve) equal to liabilities in the test condition*

	<u>Gilts</u>	<u>Land</u>	<u>Equities</u>	<u>TOTALS</u>	<u>Average Yield</u>	<u>92.5%</u>
Yield	14.2%	6.8%	4.8%			
Life assurance fund	226,950	333,750	131,101	691,801	8.85%	8.18%
General annuity fund	2,652	3,900	1,333	7,885	8.95%	8.28%
Pension business fund	24,480	36,000	2,853	63,333	9.57%	8.85%
TOTALS	254,082	373,650	135,287	763,019	8.91%	8.24%

Tables 5.4–5.6. *Illustration including contingent tax on capital gains as a liability*Table 5.4. *Apportionment of current assets equal to liabilities*

	<u>Gilts</u>	<u>Land</u>	<u>Equities</u>	<u>TOTALS</u>	<u>Average Yield</u>	<u>92.5%</u>
Yield	11.2%	5.1%	3.6%			
Life assurance fund	267,000	445,000	103,500	815,500	6.91%	6.39%
General annuity fund	3,120	5,200	1,560	9,880	6.79%	6.28%
Pension business fund	28,800	48,000	14,400	91,200	6.79%	6.28%
Contingent CGT			10,000	10,000		
TOTALS apportioned to liabilities	298,920	498,200	129,460	926,580	6.89%	6.38%
Mismatching reserve derived from Table 5.5	–	–	52,256	52,256		
	298,920	498,200	181,716	978,836		

Table 5.5. *Revised values of apportioned assets and liabilities in the '−25%, +3%' test condition*

		Gilts	Land	Equities	TOTALS
Yield		14.2%	6.8%	4.8%	
Life assurance fund	Assets	226,950	333,750	77,625	638,325
	Liabilities	226,500	377,500	87,801	691,801
		+ 450	− 43,750	− 10,176	− 53,476
General annuity fund	Assets	2,652	3,900	1,170	7,722
	Liabilities	2,490	4,150	1,245	7,885
		+ 162	− 250	− 75	− 163
Pension business fund	Assets	24,480	36,000	10,800	71,280
	Liabilities	20,000	33,333	10,000	63,333
		+ 4,480	+ 2,667	+ 800	+ 7,947
Contingent CGT	Assets			7,500	7,500
	Liabilities			1,000	1,000
				+ 6,500	+ 6,500
TOTALS	Assets	254,082	373,650	97,095	724,827
	Liabilities	248,990	414,983	100,046	764,019
		+ 5,092	− 41,333	− 2,951	− 39,192

Assuming the mismatching reserve is held as additional equities, its amount is $39,192/0.75 = 52,256$, in addition to the amount held in respect of contingent tax on capital gains in the current conditions.

Table 5.6. *Apportionment of assets (including mismatching reserve) equal to liabilities in the test condition*

	Gilts	Land	Equities	TOTALS	Average yield	92.5%
Yield	14.2%	6.8%	4.8%			
Life assurance fund	226,950	333,750	131,101	691,801	8.85%	8.18%
General annuity fund	2,652	3,900	1,333	7,885	8.95%	8.28%
Pension business fund	24,480	36,000	2,853	63,333	9.57%	8.85%
Contingent CGT			1,000	1,000		
	254,082	373,650	136,287	764,019	8.91%	8.24%

Note: In Tables 5.4 and 5.6 the assets representing contingent CGT have been excluded from the calculation of the average yield shown against 'totals'.

Table 5.7. *Possible Categories of Liabilities*

Life Assurance Fund – Non Participating:-

- Whole Life
- Endowment
- Single premium bonds
- Temporary assurances

Life Assurance Fund – Participating:-

- Whole Life
- Endowment (10 years)
- Endowment (longer terms)

General Annuity Fund – Non Participating:-

- Deferred Annuities
- Immediate Annuities

General Annuity Fund – Participating:-

- Deposit Administration
- Deferred Annuities
- Immediate Annuities

Pension Business Fund – Non Participating:-

- Group Life Assurance
- Individual Life Assurance
- Annual Premium Deferred Annuities
- Single Premium Deferred Annuities
- Immediate Annuities

Pension Business Fund – Participating:-

- Group Deposit Administration
- Individual Deposit Administration
- Annual Premium Deferred Annuities
- Single Premium Deferred Annuities
- Immediate Annuities

Capital Redemption Business

Permanent Health Insurance

Additional Reserves calculated on an aggregate basis (e.g. AIDS reserve, general contingency reserves).

Current Liabilities

Contingent Capital Gains Tax Liability

Note: The actual details of categories will depend on the individual circumstances of an office, including which types of business form a significant part of the portfolio, and whether different valuation bases apply to significant sections of some categories.

Table 5.8. *Possible Categories of Assets*

A suitable starting point for consideration is the analysis required for Forms 45 and 46 of the DTI Returns.

This would give (with a little rearranging):-

Fixed interest securities issued or guaranteed by any government or public authority:-

- Redeemable, split by unexpired term
- Irredeemable

Other fixed interest securities

Variable interest securities (excluding equity shares) issued or guaranteed by any government or public authority:-

- Capital value or interest determined by an index of prices
- Other

Land

Equity shares

Debts fully secured on land:-

- Due in more than 12 months
- Due in 12 months or less

All other assets:-

- Producing income
- Not producing income

Note: The amount of detail, particularly the number of fixed interest categories, will be varied according to what is needed and to avoid unnecessary detail.

APPENDIX 6

MODIFIED VALUATION METHODS USED FOR EXAMPLES IN

SECTION 4

1. Appendix 4 gives a brief description of the V_2 method and its derivatives. This appendix describes the derivation of a further method used in the work described in Section 4.

2. The Regulations allow for all sums invested or reinvested within 3 years of the valuation date to obtain current yields, but for any subsequent payments to be invested only at the valuation rate of interest, subject to the 7.2% restriction. Since the W_2 method involves adjusting net premiums and reserves to take account of the current yield on assets, it does not seem practicable to allow the '3 year reinvestment rule' to be incorporated in addition. Accordingly no account has been taken of it in the calculation of reserves described below.

3. A further problem arises when the assets under consideration have a shorter outstanding term than the policy being valued. A modification has been suggested by Mr A.E.M. Fine which takes credit for V earning g only until the asset matures at which time V is reinvested to earn i , the valuation rate of interest. In the W_2 formula,

$$P_{x:\overline{m}}^i \ddot{a}_{x+t:\overline{n-t}}^i$$

would be replaced by

$$P_{x:\overline{m}}^i \ddot{a}_{x+t:\overline{m-t}}^i + P_{x:\overline{n}-(m-t)}^i \ddot{a}_{x+t:\overline{n-m}}^i$$

where m is the original asset term and $m < n$.

4. For ease of calculation, this refinement can be considered as a means of bringing W_2 back closer to V_1 if the asset term is less than that of the liability and so, for the endowment, the following approximation can be justified:-

$${}_{m,t}W_{3,x:\overline{n}}^{(i,g)} = \frac{(\ddot{a}_{x+t:\overline{m-t}}^i \times W_2) + ({}_{(m-t)}\ddot{a}_{x+t:\overline{n-m}}^i \times V_1)}{\ddot{a}_{x+t:\overline{n-t}}^i}$$

This reserve is designated here as ' W_3 '.

5. For term assurances and other contracts with a fixed option or termination date, the above method works adequately but for whole life assurances, an alternative is required. Instead of i' tracking from i to g over the fixed term, it is assumed that the linear interpolation between W_2 and V_1 is based on the expired duration and the future expectation of life. This modification is simple to apply in practice and the formula for i' is as follows:

$$i'_t = \frac{gt + e_{x+t}i}{t + e_{x+t}}$$

6. These methods may be applied to valuing immediate annuities by taking account of the fact that under such contracts no reinvestment of income is

required. It is assumed that the current yield g continues to be earned on the current asset holding until that asset is redeemed after n years; thereafter a yield of i is assumed. Thus,

$$\ddot{a}'_x = \ddot{a}^g_{x:\overline{n}|} + \frac{1}{(1+g)^n} \frac{l_{x+n}}{l_x} \ddot{a}^i_{x+n}$$

In the context of immediate annuities only, this may be considered to be an extension of the '3 year rule' described in § 2 of this appendix with the running yield being maintained until redemption rather than for only 3 years.

7. Zillmer adjustments can be incorporated in W_3 net premiums in a similar way as with V_1 net premiums. The Zillmer adjustment is restricted to 3.5% of the capital sum payable under the contract, or the actual expense allowance less tax within the office premium, whichever is less. A further restriction which bites hardest for without profits contracts and term assurances is that the net premium valued must not exceed the office premium (less a suitable allowance for expenses).

8. Assessing the effect of these limits requires specification of scales of office premiums and their expense content. For permanent contracts, expenses have been taken to be 3.5% of the office premium per year of term subject to a maximum of 25 years (35 for whole-life). For temporary assurances, the allowance is 15% per annum subject to a maximum of 10 years counting. Tax relief has been assumed at 35% in the life fund. The following table shows the office premium rates per mille together with the Zillmer adjustments (expressed as percentages of the sum assured or cash option) based on the above formula for both the with and without profits contracts.

		Without profits rate per mille £	With profits rate per mille £	With profits Zillmer %	Without profits Zillmer %
Whole-life	male 30	8.34	22.66	2.0	.75
Whole-life	male 50	22.57	43.17	3.5	1.75
10 year endowment	male 50	83.12	109.60	2.5	2.00
25 year endowment	male 35	24.00	43.70	2.5	1.25
10 year temporary	male 50	7.50	n/a	—	.70
25 year temporary	male 35	3.10	n/a	—	.30
Deferred annuity	25 years	n/a	n/a	3.5	—

9. The effect of using the office premium for without profits contracts is that the initial reserve V_0 (the reserve immediately before payment of the first premium) which would otherwise equal minus 3.5% of the sum assured (or such lower percentage as is allowed by consideration of the expense content of the office premiums) becomes positive and substantial. The following table illustrates the effect for a 25 year without profits endowment assurance effected by a male life aged 35 next birthday, with $i = 1.80\%$:

	Premium	Initial reserve
Net (with 1.25% Zillmer)	33.25	— 12.50
Restricted net premium	24.00	175.00

The increase in the initial reserve represents almost 8 times the office premium.

10. This feature also affects the outcome of mismatching tests depending on whether either or both interest rates lead to excessive net premiums. For example, consider the same contract 5 years after the outset with equities yielding 3% initially, changing to 4%. This implies an increase in i from 1.80% to 2.41% (i.e. $4.00\% \times .65 \times .925$).

	Basis A	Basis B
Initial mathematical liability	158	314
Initial solvency margin	9	15
Total liability (= initial asset value)	167	329
Revised mathematical liability	148	257
Revised solvency margin	8	13
Revised total liability	156	270
Revised asset value	125	247
Amount of mismatching reserve	31	23
Mismatching reserve as % of asset value	25%	9%

Basis A assumes an unrestricted net premium with a Zillmer adjustment of 1.25%.

Basis B assumes the net premium is restricted to the office premium.

APPENDIX 7

**MISMATCHING RESERVES FOR HYPOTHETICAL ASSET AND LIABILITY
COMBINATIONS, AS DESCRIBED IN SECTION 4**

Table 7.1.2. Required Mismatching Reserve

Source table		7.2.																					
Asset category	Yield	Endowment Assurance (without profits)					Endowment Assurance (with profits)					Level Term Assurance											
		10 year		25 year		35 year		10 year		25 year		35 year		10 year		25 year		35 year					
		age 50	dur'n 5	age 35	dur'n 5	age 35	dur'n 5	age 50	dur'n 5	age 35	dur'n 5	age 50	dur'n 5	age 35	dur'n 5	age 50	dur'n 5	age 35	dur'n 5				
		%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%				
Equities	3	4	28	9	25		31	21	27		33	18	28										
Equities	6	8	23	-9	19		28	11	21		25	17	24										
Fixed interest	5	10	5	-4	4		6	0	3		5	-3	4										
Fixed interest	7	10	13	1	9		14	5	7		13	-1	9										
Fixed interest	25	7	10	25	10	21	27	11	19		26	5	21										
Fixed interest	5	7	4																				
Fixed interest	10	7	4	-5	64	2	-12	10	-4		-5	21	1										
Fixed interest	25	7	4	-19	41	-12	-24	-5	-17		-12	12	-7										
Fixed interest	5	10	13	8	8	7	6	7	6		4	6	6										
Fixed interest	10	13	15	13	13	10	13	11	8		11	13	6										
Fixed interest	25	10	13	23	19	18	21	13	15		19	13	13										
Fixed interest	5	7	-5	4	4	-4	-6	0	-3		-5	3	-4										
Fixed interest	10	7	-12	-1	-8	-7	-12	-5	-7		-11	1	-8										
Fixed interest	25	10	7	-21	-9	-18	-21	-10	-16		-20	-5	-17										
Deposits	7	10	-6	-18	-9		-5	-17	-11		-6	-22	-10										
Deposits	7	4	14	97	23		6	33	15		6	35	12										
Deposits	10	13	-3	-6	-7		-5	-11	-10		-7	-11	-11										
Deposits	10	7	6	22	10		5	20	13		7	28	11										

Table 7.1.3. Required Mismatching Reserve

Source table		7.2.											Deferred Annuity With Cash Option at age 65 (age 40 at outset)									
Asset category	term	Yield current revised	Immediate Annuity (yearly in advance)					without profits					with profits					with profits				
			male age 60		male age 80		single premium		single premium		annual premium		annual premium		single premium		single premium		single premium		single premium	
			level	5% esc	level	5% esc	dur'n 5	dur'n 15	dur'n 5	dur'n 15	dur'n 5	dur'n 15	dur'n 5	dur'n 15	dur'n 5	dur'n 15	dur'n 5	dur'n 15	dur'n 5	dur'n 15	dur'n 5	dur'n 15
			%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%
Equities		3	22	19	28	27	12	22	13	23	12	22	13	23	12	22	13	23	12	22	13	23
		6	16	11	24	22	-4	13	-3	14	-4	13	-3	14	-4	13	-3	14	-4	13	-3	14
Fixed interest	5	7	-1	-3	3	2	-9	-3	-7	-2	-9	-3	-7	-2	-9	-3	-7	-2	-9	-3	-7	-2
	10	7	3	-1	9	8	-7	-1	-4	0	-7	-1	-4	0	-7	-1	-4	0	-7	-1	-4	0
Fixed interest	25	7	11	4	21	19	-4	10	2	12	-4	10	2	12	-4	10	2	12	-4	10	2	12
	5	7	12	22	0	3	52	17	16	12	52	17	16	12	52	17	16	12	52	17	16	12
Fixed interest	10	7	4	12	-7	-5	41	8	7	3	41	8	7	3	41	8	7	3	41	8	7	3
	25	7	-10	-3	-20	-18	22	-7	-7	-11	22	-7	-7	-11	22	-7	-7	-11	22	-7	-7	-11
Fixed interest	5	10	2	1	4	3	4	3	6	3	4	3	6	3	4	3	6	3	4	3	6	3
	10	10	4	1	9	7	4	1	9	3	4	1	9	3	4	1	9	3	4	1	9	3
Fixed interest	25	10	9	3	16	14	3	9	10	10	3	9	10	10	3	9	10	10	3	9	10	10
	5	10	1	3	-3	-2	10	3	8	2	10	3	8	2	10	3	8	2	10	3	8	2
Fixed interest	10	10	-3	1	-9	-7	8	1	4	0	8	1	4	0	8	1	4	0	8	1	4	0
	25	10	-10	-4	-18	-16	4	-9	-2	10	4	-9	-2	10	4	-9	-2	10	4	-9	-2	10
Deposits		7	-17	-22	-9	-11	-28	18	-24	-17	-28	18	-24	-17	-28	18	-24	-17	-28	18	-24	-17
	4	7	25	36	12	14	25	30	29	25	25	30	29	25	25	30	29	25	25	30	29	25
Deposits		10	-15	-19	-9	-10	-19	-15	-14	-13	-19	-15	-14	-13	-19	-15	-14	-13	-19	-15	-14	-13
	7	10	21	29	10	13	39	22	31	20	39	22	31	20	39	22	31	20	39	22	31	20

Table 7.1.4. Required Mismatching Reserve

Source table 7.2.			32	33	34	35	36
Asset category	Yield term	current revised	CGT Reserve for Unrealised Equity Life Fund Appreciation				
			Fixed Liability	30% appreciation	100% appreciation	change in current asset value of equities	
			\$	\$	\$	\$	%
Equities	3	4	33	-100	N/A	-33	N/A
Equities	6	8	33	-100	N/A	-33	N/A
Fixed Interest	5	7	12	-100	12	-44	12
Fixed Interest	10	7	20	-100	20	-40	20
Fixed Interest	25	7	34	-100	34	-33	34
Fixed Interest	5	7	-10	-100	-10	-55	-10
Fixed Interest	10	7	-17	-100	-17	-58	-17
Fixed Interest	25	7	-28	-100	-28	-64	-28
Fixed interest	5	10	11	-100	11	-44	11
Fixed interest	10	10	19	-100	19	-41	19
Fixed interest	25	10	27	-100	27	-37	27
Fixed Interest	5	10	-11	-100	-11	-55	-11
Fixed Interest	10	10	-17	-100	-17	-59	-17
Fixed Interest	25	10	-25	-100	-25	-63	-25
Deposits	7	10	0	-100	0	-50	0
Deposits	7	4	0	-100	0	-50	0
Deposits	10	13	0	-100	0	-50	0
Deposits	10	7	0	-100	0	-50	0

Tables 7.2. Details of Calculations

Non profit		Whole-life Assurance		Male 30 next at entry		Duration 5 years		Sum assured £ 1,000								
Table 7.2.1		Tax rate 35%		Solvency 4%		Solvency .003		Zillmer .75%								
asset category	asset term	current yield	current i	current g	revised yield	revised i	revised g	current asset value	current total reserve	current margin	revised				amount required of mismatch reserve	
											mathematical reserve	revised asset value	revised margin	revised total reserve		
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	
Equities		3%	1.80%	1.80%	4%	2.41%	2.41%	263	12.73	276	276	207	187	9.92	197	-9.88 -4.78%
Equities		6%	3.61%	3.61%	8%	4.68%	4.81%	88	6.26	94	94	71	34	4.26	38	-32.43 -45.88%
Fixed interest	5	7%	4.21%	4.21%	10%	4.68%	6.01%	55	5.04	60	60	54	34	4.26	38	-15.36 -28.65%
Fixed interest	10	7%	4.21%	4.21%	10%	4.68%	6.01%	55	5.04	60	60	50	33	4.22	37	-12.61 -25.31%
Fixed interest	25	7%	4.21%	4.21%	10%	4.68%	6.01%	55	5.04	60	60	45	32	4.18	36	-8.62 -19.24%
Fixed interest	5	7%	4.21%	4.21%	4%	2.41%	2.41%	55	5.04	60	60	67	187	9.92	197	129.99 194.21%
Fixed interest	10	7%	4.21%	4.21%	4%	2.41%	2.41%	55	5.04	60	60	72	187	9.92	197	124.62 172.37%
Fixed interest	25	7%	4.21%	4.21%	4%	2.41%	2.41%	55	5.04	60	60	84	187	9.92	197	113.18 135.16%
Fixed interest	5	10%	4.68%	6.01%	13%	4.68%	7.82%	34	4.26	38	38	34	33	4.27	37	2.89 8.43%
Fixed interest	10	10%	4.68%	6.01%	13%	4.68%	7.82%	33	4.22	37	37	31	32	4.18	36	4.86 15.50%
Fixed interest	25	10%	4.68%	6.01%	13%	4.68%	7.82%	32	4.18	36	36	28	30	4.11	34	5.68 19.97%
Fixed interest	5	10%	4.68%	6.01%	7%	4.21%	4.21%	34	4.26	38	38	43	55	5.04	60	17.70 40.15%
Fixed interest	10	10%	4.68%	6.01%	7%	4.21%	4.21%	33	4.22	37	37	45	55	5.04	60	15.19 33.88%
Fixed interest	25	10%	4.68%	6.01%	7%	4.21%	4.21%	32	4.18	36	36	48	55	5.04	60	11.55 23.87%
Deposits		7%	4.21%	4.21%	10%	4.68%	6.01%	55	5.04	60	60	60	32	4.18	36	21.05 30.71%
Deposits		7%	4.21%	4.21%	4%	2.41%	2.41%	55	5.04	60	60	60	187	9.92	197	136.00 278.01%
Deposits		10%	4.68%	6.01%	13%	4.68%	7.82%	32	4.18	36	36	36	29	4.07	33	1.11 8.60%
Deposits		10%	4.68%	6.01%	7%	4.21%	4.21%	32	4.18	36	36	36	55	5.04	60	21.05 65.97%

Non profit		Whole-life Assurance			Male 30 next at entry			Duration 10 years			Sum assured £ 1,000						
Table 7.2.2		Tax rate 35%		Solvency 4%		Solvency .003		Zillmer .75%									
asset category	asset term	current yield	current i	current g	revised yield	revised i	revised g	current			revised			amount required			
								mathematical reserve	solvency margin	total reserve	current asset value	revised asset value	mathematical reserve		solvency margin	total reserve	
Equities	Equities	3%	1.80%	1.80%	4%	2.41%	2.41%	327	15.10	342	342	257	251	12.29	263	6.71	2.62%
		6%	3.61%	3.61%	8%	4.68%	4.81%	146	8.40	154	154	116	85	6.15	91	-24.66	-21.29%
Fixed interest	5	7%	4.21%	4.21%	10%	4.68%	6.01%	109	7.03	116	116	104	84	6.11	90	-13.52	-13.05%
Fixed interest	10	7%	4.21%	4.21%	10%	4.68%	6.01%	109	7.03	116	116	96	82	6.03	88	-8.28	-8.60%
Fixed interest	25	7%	4.21%	4.21%	10%	4.68%	6.01%	109	7.03	116	116	87	78	5.89	84	-2.71	-3.13%
Fixed interest	5	7%	4.21%	4.21%	4%	2.41%	2.41%	109	7.03	116	116	129	251	12.29	263	133.93	103.53%
Fixed interest	10	7%	4.21%	4.21%	4%	2.41%	2.41%	109	7.03	116	116	140	251	12.29	263	123.55	88.42%
Fixed interest	25	7%	4.21%	4.21%	4%	2.41%	2.41%	109	7.03	116	116	162	251	12.29	263	101.44	62.68%
Fixed interest	5	10%	4.68%	6.01%	13%	4.68%	7.82%	84	6.11	90	90	81	81	6.00	87	6.15	7.60%
Fixed interest	10	10%	4.68%	6.01%	13%	4.68%	7.82%	82	6.03	88	88	74	78	5.89	84	9.79	13.21%
Fixed interest	25	10%	4.68%	6.01%	13%	4.68%	7.82%	78	5.89	84	84	66	71	5.63	77	10.71	16.25%
Fixed interest	5	10%	4.68%	6.01%	7%	4.21%	4.21%	84	6.11	90	90	101	109	7.03	116	15.14	15.01%
Fixed interest	10	10%	4.68%	6.01%	7%	4.21%	4.21%	82	6.03	88	88	106	109	7.03	116	9.98	9.41%
Fixed interest	25	10%	4.68%	6.01%	7%	4.21%	4.21%	78	5.89	84	84	112	109	7.03	116	3.63	3.23%
Deposits		7%	4.21%	4.21%	10%	4.68%	6.01%	109	7.03	116	116	116	77	5.85	83	-33.18	-28.60%
Deposits		7%	4.21%	4.21%	4%	2.41%	2.41%	109	7.03	116	116	116	251	12.29	263	147.25	126.91%
Deposits		10%	4.68%	6.01%	13%	4.68%	7.82%	77	5.85	83	83	83	68	5.52	74	-9.33	-11.27%
Deposits		10%	4.68%	6.01%	7%	4.21%	4.21%	77	5.85	83	83	83	109	7.03	116	33.18	40.05%

Table 7.2.3 Tax rate 35%																		
Non profit		Whole-life Assurance			Male 30 next at entry			Duration 25 years			Sum assured £ 1,000							
Table 7.2.3		Solvency 4%			Solvency .003			Zillmer .75%										
asset category	asset term	current yield	current i	current g	revised yield	revised i	revised g	current mathe- matical reserve	current solvency margin	current total reserve	current asset value	revised asset value	revised mathe- matical reserve	revised solvency margin	revised total reserve	amount of mismatch reserve required		
																	(1)	(2)
Equities	Equities	3%	1.80%	1.80%	4%	2.41%	2.41%	539	22.94	562	562	421	471	20.43	491	69.97	16.60%	
		6%	3.61%	3.61%	8%	4.68%	4.81%	366	16.54	383	383	287	292	13.80	306	18.90	6.59%	
Fixed interest	5	7%	4.21%	4.21%	10%	4.68%	6.01%	324	14.99	339	339	303	285	13.55	299	-4.21	-1.39%	
Fixed interest	10	7%	4.21%	4.21%	10%	4.68%	6.01%	324	14.99	339	339	281	278	13.29	291	9.90	3.52%	
Fixed interest	25	7%	4.21%	4.21%	10%	4.68%	6.01%	324	14.99	339	339	253	266	12.84	279	25.86	10.22%	
Fixed interest	5	7%	4.21%	4.21%	4%	2.41%	2.41%	324	14.99	339	339	378	471	20.43	491	113.50	30.03%	
Fixed interest	10	7%	4.21%	4.21%	4%	2.41%	2.41%	324	14.99	339	339	408	471	20.43	491	83.19	20.38%	
Fixed interest	25	7%	4.21%	4.21%	4%	2.41%	2.41%	324	14.99	339	339	473	471	20.43	491	18.60	3.93%	
Fixed interest	5	10%	4.68%	6.01%	13%	4.68%	7.82%	285	13.55	299	299	268	274	13.14	287	19.27	7.19%	
Fixed interest	10	10%	4.68%	6.01%	13%	4.68%	7.82%	278	13.29	291	291	245	259	12.58	272	26.41	10.77%	
Fixed interest	25	10%	4.68%	6.01%	13%	4.68%	7.82%	266	12.84	279	279	219	236	11.73	248	28.63	13.07%	
Fixed interest	5	10%	4.68%	6.01%	7%	4.21%	4.21%	285	13.55	299	299	334	324	14.99	339	4.71	1.41%	
Fixed interest	10	10%	4.68%	6.01%	7%	4.21%	4.21%	278	13.29	291	291	351	324	14.99	339	-11.93	-3.40%	
Fixed interest	25	10%	4.68%	6.01%	7%	4.21%	4.21%	266	12.84	279	279	374	324	14.99	339	-34.65	-9.27%	
Deposits		7%	4.21%	4.21%	10%	4.68%	6.01%	324	14.99	339	339	339	265	12.81	278	-61.18	-18.08%	
Deposits		7%	4.21%	4.21%	4%	2.41%	2.41%	324	14.99	339	339	339	471	20.43	491	152.44	44.97%	
Deposits		10%	4.68%	6.01%	13%	4.68%	7.82%	265	12.81	278	278	278	232	11.68	244	-34.72	-12.37%	
Deposits		10%	4.68%	6.01%	7%	4.21%	4.21%	265	12.81	278	278	278	324	14.99	339	61.18	22.07%	

Table 7.2.6 Non profit Whole-life Assurance Male 50 next at entry Duration 25 years Sum assured £ 1,000

Table 7.2.6		Tax rate 35%		Solvency 4%			Solvency .003			Zillmer 1.75%							
asset category	asset term	current yield	current i	current g	revised yield	revised i	revised g	current			revised						
								mathe- reserve	mathe- solvency	current margin	current reserve	total value	asset value	revised asset value	mathe- reserve	mathe- solvency	revised margin
		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)
Equities	Equities	3%	1.80%	1.80%	4%	2.41%	2.41%	680	28.16	708	708	531	646	26.90	673	141.78	26.69%
		6%	3.61%	3.61%	8%	4.68%	4.81%	587	24.72	612	612	459	536	22.83	559	100.04	21.81%
Fixed Interest	5	7%	4.21%	4.21%	10%	4.68%	6.01%	560	23.72	584	584	521	517	22.13	539	17.80	3.42%
	10	7%	4.21%	4.21%	10%	4.68%	6.01%	560	23.72	584	584	485	505	21.69	527	42.16	8.70%
	25	7%	4.21%	4.21%	10%	4.68%	6.01%	560	23.72	584	584	436	499	21.46	520	84.84	19.47%
Fixed Interest	5	7%	4.21%	4.21%	4%	2.41%	2.41%	560	23.72	584	584	651	646	26.90	673	22.14	3.40%
	10	7%	4.21%	4.21%	4%	2.41%	2.41%	560	23.72	584	584	703	646	26.90	673	-30.06	-4.28%
	25	7%	4.21%	4.21%	4%	2.41%	2.41%	560	23.72	584	584	814	646	26.90	673	-141.29	-17.35%
Fixed Interest	5	10%	4.68%	6.01%	13%	4.68%	7.82%	517	22.13	539	539	484	496	21.35	517	33.62	6.95%
	10	10%	4.68%	6.01%	13%	4.68%	7.82%	505	21.69	527	527	443	473	20.50	494	50.20	11.33%
	25	10%	4.68%	6.01%	13%	4.68%	7.82%	499	21.46	520	520	409	462	20.09	482	73.14	17.88%
Fixed Interest	5	10%	4.68%	6.01%	7%	4.21%	4.21%	517	22.13	539	539	604	560	23.72	584	-19.94	-3.30%
	10	10%	4.68%	6.01%	7%	4.21%	4.21%	505	21.69	527	527	635	560	23.72	584	-50.79	-8.00%
	25	10%	4.68%	6.01%	7%	4.21%	4.21%	499	21.46	520	520	697	560	23.72	584	-113.68	-16.30%
Deposits		7%	4.21%	4.21%	10%	4.68%	6.01%	560	23.72	584	584	584	499	21.46	520	-63.26	-10.84%
		7%	4.21%	4.21%	4%	2.41%	2.41%	560	23.72	584	584	584	646	26.90	673	89.18	15.28%
		10%	4.68%	6.01%	13%	4.68%	7.82%	499	21.46	520	520	520	462	20.09	482	-38.37	-7.37%
Deposits		10%	4.68%	6.01%	7%	4.21%	4.21%	499	21.46	520	520	520	560	23.72	584	63.26	12.15%

With profit		Whole-life Assurance		Male 30 next at entry		Duration 5 years		Sum assured £ 1,000		Bonus £ 276							
Tax rate 35%		Solvency 4%		Solvency .003		Zillmer 2.0%											
Table 7.2.7																	
asset category	asset term	current yield	current i	current g	revised yield	revised i	revised g	current		revised		total reserve	revised margin	total reserve	revised margin	total mismatch	amount required
								mathe-	mathe-	mathe-	mathe-						
		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)
Equities		3%	1.80%	1.80%	4%	2.41%	2.41%	195	11.04	206	206	155	159	9.71	169	14.18	9.18%
		6%	3.61%	3.61%	8%	4.68%	4.81%	106	7.75	114	114	85	73	6.53	80	-5.78	-6.78%
Fixed Interest	5	7%	4.21%	4.21%	10%	4.68%	6.01%	87	7.05	94	94	84	72	6.49	78	-5.50	-6.55%
	10	7%	4.21%	4.21%	10%	4.68%	6.01%	87	7.05	94	94	78	69	6.38	75	-2.68	-3.44%
Fixed Interest	25	7%	4.21%	4.21%	10%	4.68%	6.01%	87	7.05	94	94	70	66	6.27	72	2.08	2.97%
Fixed Interest	5	7%	4.21%	4.21%	4%	2.41%	2.41%	87	7.05	94	94	105	159	9.71	169	63.86	60.91%
	10	7%	4.21%	4.21%	4%	2.41%	2.41%	87	7.05	94	94	113	159	9.71	169	55.45	48.96%
Fixed Interest	25	7%	4.21%	4.21%	4%	2.41%	2.41%	87	7.05	94	94	131	159	9.71	169	37.53	28.61%
Fixed Interest	5	10%	4.68%	6.01%	13%	4.68%	7.82%	72	6.49	78	78	70	69	6.38	75	4.95	7.03%
	10	10%	4.68%	6.01%	13%	4.68%	7.82%	69	6.38	75	75	63	65	6.23	71	7.79	12.27%
Fixed Interest	25	10%	4.68%	6.01%	13%	4.68%	7.82%	66	6.27	72	72	57	58	5.97	64	7.19	12.66%
Fixed Interest	5	10%	4.68%	6.01%	7%	4.21%	4.21%	72	6.49	78	78	88	87	7.05	94	6.16	7.01%
	10	10%	4.68%	6.01%	7%	4.21%	4.21%	69	6.38	75	75	91	87	7.05	94	3.23	3.56%
Fixed Interest	25	10%	4.68%	6.01%	7%	4.21%	4.21%	66	6.27	72	72	97	87	7.05	94	-2.79	-2.88%
Deposits		7%	4.21%	4.21%	10%	4.68%	6.01%	87	7.05	94	94	94	64	6.20	70	-23.85	-25.36%
		7%	4.21%	4.21%	4%	2.41%	2.41%	87	7.05	94	94	94	159	9.71	169	74.66	79.39%
Deposits		10%	4.68%	6.01%	13%	4.68%	7.82%	64	6.20	70	70	70	54	5.83	60	-10.37	-14.77%
		10%	4.68%	6.01%	7%	4.21%	4.21%	64	6.20	70	70	70	87	7.05	94	23.85	33.98%

With profit		Whole-life Assurance		Male 30 next at entry		Duration 10 years		Sum assured £ 1,000		Bonus £ 628								
Table 7.2.8		Tax rate 35%		Solvency 4%		Solvency .003		Zillmer 2.0%										
asset category	asset term	current yield		current g		current i		revised asset value		revised total reserve		amount required of mismatch reserve						
		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	
		current		current		current		current		current		current		current		current		
Equities	Equities	3%	1.80%	1.80%	4%	2.41%	2.41%	482	22.72	505	307	307	379	405	19.87	425	46.33	12.24%
		5%	3.61%	3.61%	8%	4.68%	4.81%	291	15.65	307	307	307	379	216	12.88	229	-1.11	- .48%
Fixed interest	5	7%	4.21%	4.21%	10%	4.68%	6.01%	248	14.06	262	262	262	334	211	12.69	224	-10.36	-4.42%
Fixed interest	10	7%	4.21%	4.21%	10%	4.68%	6.01%	248	14.06	262	262	262	316	204	12.43	216	-1.09	- .50%
Fixed interest	25	7%	4.21%	4.21%	10%	4.68%	6.01%	248	14.06	262	262	262	366	191	11.95	203	7.38	3.77%
Fixed interest	5	7%	4.21%	4.21%	4%	2.41%	2.41%	248	14.06	262	262	262	292	405	19.87	425	132.71	45.42%
Fixed interest	10	7%	4.21%	4.21%	4%	2.41%	2.41%	248	14.06	262	262	262	316	405	19.87	425	109.27	34.62%
Fixed interest	25	7%	4.21%	4.21%	4%	2.41%	2.41%	248	14.06	262	262	262	366	405	19.87	425	59.34	16.23%
Fixed interest	5	10%	4.68%	6.01%	13%	4.68%	7.82%	211	12.69	224	224	224	201	203	12.40	215	14.69	7.32%
Fixed interest	10	10%	4.68%	6.01%	13%	4.68%	7.82%	204	12.43	216	216	216	182	189	11.88	201	18.71	10.27%
Fixed interest	25	10%	4.68%	6.01%	13%	4.68%	7.82%	191	11.95	203	203	203	159	165	10.99	176	16.52	10.36%
Fixed interest	5	10%	4.68%	6.01%	7%	4.21%	4.21%	211	12.69	224	224	224	250	248	14.06	262	11.60	4.63%
Fixed interest	10	10%	4.68%	6.01%	7%	4.21%	4.21%	204	12.43	216	216	216	261	248	14.06	262	1.32	.51%
Fixed interest	25	10%	4.68%	6.01%	7%	4.21%	4.21%	191	11.95	203	203	203	272	248	14.06	262	-9.88	-3.63%
deposits		7%	4.21%	4.21%	10%	4.68%	6.01%	248	14.06	262	262	262	262	186	11.77	198	-64.29	-24.53%
deposits		7%	4.21%	4.21%	4%	2.41%	2.41%	248	14.06	262	262	262	262	405	19.87	425	162.81	62.13%
deposits		10%	4.68%	6.01%	13%	4.68%	7.82%	186	11.77	198	198	198	198	156	10.66	167	-31.11	-15.73%
deposits		10%	4.68%	6.01%	7%	4.21%	4.21%	186	11.77	198	198	198	198	248	14.06	262	64.29	32.51%

Table 7.2.9																	
With profit		Whole-life Assurance			Male 30 next at entry			Duration 25 years			Sum assured £ 1,000		Bonus £ 2,386				
Tax rate 35%		Solvency 4%		Solvency .003		Zillmer 2.0%											
asset category	asset term	current yield	current i	revised yield	revised i	current			revised asset value	revised margin	mathematical reserve	revised solvency	revised margin	total reserve	amount of mismatch	required reserve	
						mathe-	mathe-	mathe-									

Equities		3%	1.80%	1.80%	4%	2.41%	2.41%	2,052	86.08	2,138	2,138	1,604	1,840	78.24	1,918	314.68	19.62%
Equities		6%	3.61%	3.61%	8%	4.68%	4.81%	1,498	65.58	1,564	1,564	1,173	1,241	56.08	1,297	124.39	10.61%
Fixed interest	5	7%	4.21%	4.21%	10%	4.68%	6.01%	1,358	60.40	1,418	1,418	1,267	1,202	54.63	1,257	-10.15	-8.0%
Fixed interest	10	7%	4.21%	4.21%	10%	4.68%	6.01%	1,358	60.40	1,418	1,418	1,177	1,160	53.08	1,213	35.71	3.03%
Fixed interest	25	7%	4.21%	4.21%	10%	4.68%	6.01%	1,358	60.40	1,418	1,418	1,059	1,097	50.75	1,148	89.20	8.43%
Fixed interest	5	7%	4.21%	4.21%	4%	2.41%	2.41%	1,358	60.40	1,418	1,418	1,581	1,840	78.24	1,918	336.92	21.31%
Fixed interest	10	7%	4.21%	4.21%	4%	2.41%	2.41%	1,358	60.40	1,418	1,418	1,708	1,840	78.24	1,918	210.07	12.30%
Fixed interest	25	7%	4.21%	4.21%	4%	2.41%	2.41%	1,358	60.40	1,418	1,418	1,978	1,840	78.24	1,918	-60.20	-3.04%
Fixed interest	5	10%	4.68%	6.01%	13%	4.68%	7.82%	1,202	54.63	1,257	1,257	1,128	1,146	52.56	1,199	71.04	6.30%
Fixed interest	10	10%	4.68%	6.01%	13%	4.68%	7.82%	1,160	53.08	1,213	1,213	1,021	1,061	49.42	1,110	89.40	8.76%
Fixed interest	25	10%	4.68%	6.01%	13%	4.68%	7.82%	1,097	50.75	1,148	1,148	902	936	44.79	981	78.94	8.75%
Fixed interest	5	10%	4.68%	6.01%	7%	4.21%	4.21%	1,202	54.63	1,257	1,257	1,407	1,358	60.40	1,418	11.37	.81%
Fixed interest	10	10%	4.68%	6.01%	7%	4.21%	4.21%	1,160	53.08	1,213	1,213	1,461	1,358	60.40	1,418	-43.03	-2.94%
Fixed interest	25	10%	4.68%	6.01%	7%	4.21%	4.21%	1,097	50.75	1,148	1,148	1,538	1,358	60.40	1,418	-119.52	-7.77%
Deposits		7%	4.21%	4.21%	10%	4.68%	6.01%	1,358	60.40	1,418	1,418	1,418	1,088	50.41	1,138	-279.99	-19.74%
Deposits		7%	4.21%	4.21%	4%	2.41%	2.41%	1,358	60.40	1,418	1,418	1,418	1,840	78.24	1,918	499.83	35.24%
Deposits		10%	4.68%	6.01%	13%	4.68%	7.82%	1,088	50.41	1,138	1,138	1,138	918	44.12	962	-176.29	-15.49%
Deposits		10%	4.68%	6.01%	7%	4.21%	4.21%	1,088	50.41	1,138	1,138	1,138	1,358	60.40	1,418	279.99	24.59%

With profit		Whole-life Assurance		Male 50 next at entry		Duration 5 years		Sum assured £ 1,000		Bonus £ 276								
Table 7.2.10 Tax rate 35%		Solvency 4%		Solvency .003		Zillmer 3.5%												
asset category	asset term	current yield		revised yield		current margin		revised asset value		revised mathematical reserve		revised total reserve		amount required of mismatch reserve				
		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	
		3%	1.80%	1.80%	4%	2.41%	2.41%	294	14.71	309	309	232	264	13.60	278	46.07	19.90%	
Equities	Equities	6%	3.61%	3.61%	8%	4.68%	4.81%	215	11.78	227	227	170	178	10.41	188	18.33	10.77%	
	Fixed interest	5	7%	4.21%	4.21%	10%	4.68%	6.01%	195	11.04	206	206	184	174	10.27	184	.25	.13%
	Fixed interest	10	7%	4.21%	4.21%	10%	4.68%	6.01%	195	11.04	206	206	171	169	10.08	179	8.05	4.71%
Fixed interest	Fixed interest	25	7%	4.21%	4.21%	10%	4.68%	6.01%	195	11.04	206	206	154	161	9.79	171	17.02	11.07%
	Fixed interest	5	7%	4.21%	4.21%	4%	2.41%	2.41%	195	11.04	206	206	230	264	13.60	278	47.89	20.85%
	Fixed interest	10	7%	4.21%	4.21%	4%	2.41%	2.41%	195	11.04	206	206	248	264	13.60	278	29.46	11.87%
Fixed interest	Fixed interest	25	7%	4.21%	4.21%	4%	2.41%	2.41%	195	11.04	206	206	287	264	13.60	278	-9.80	-3.41%
	Fixed interest	5	10%	4.68%	6.01%	13%	4.68%	7.82%	174	10.27	184	184	165	167	10.01	177	11.67	7.06%
	Fixed interest	10	10%	4.68%	6.01%	13%	4.68%	7.82%	169	10.08	179	179	151	157	9.64	167	15.91	10.55%
Fixed interest	Fixed interest	25	10%	4.68%	6.01%	13%	4.68%	7.82%	161	9.79	171	171	134	142	9.08	151	16.89	12.58%
	Fixed interest	5	10%	4.68%	6.01%	7%	4.21%	4.21%	174	10.27	184	184	206	195	11.04	206	-.28	-.13%
	Fixed interest	10	10%	4.68%	6.01%	7%	4.21%	4.21%	169	10.08	179	179	216	195	11.04	206	-9.70	-4.50%
Fixed interest	Fixed interest	25	10%	4.68%	6.01%	7%	4.21%	4.21%	161	9.79	171	171	229	195	11.04	206	-22.80	-9.98%
	Deposits		7%	4.21%	4.21%	10%	4.68%	6.01%	195	11.04	206	206	206	160	9.75	170	-36.30	-17.62%
	Deposits		7%	4.21%	4.21%	4%	2.41%	2.41%	195	11.04	206	206	206	264	13.60	278	71.55	34.73%
Deposits	Deposits		10%	4.68%	6.01%	13%	4.68%	7.82%	160	9.75	170	170	170	140	9.01	149	-20.74	-12.22%
	Deposits		10%	4.68%	6.01%	7%	4.21%	4.21%	160	9.75	170	170	170	195	11.04	206	36.30	21.38%

With profit		Whole-life Assurance		Male 50 next at entry		Duration 25 years		Sum assured £ 1,000		Bonus £ 2,386							
Tax rate 35%		Solvency 4%		Solvency .003		Zillmer 3.5%											
asset category	asset term	current		current		current		revised		revised							
		yield	i	current	total	current	asset value	revised asset value	mathematical reserve	revised solvency margin	total reserve						
		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)
Equities	Equities	3%	1.80%	1.80%	4%	2.41%	2.41%	2,661	108.62	2,770	2,770	2,077	2,549	104.47	2,653	576.26	27.74%
	Equities	6%	3.61%	3.61%	8%	4.68%	4.81%	2,350	97.11	2,447	2,447	1,835	2,175	90.63	2,266	430.30	23.45%
Fixed interest	Fixed interest	5	7%	4.21%	4.21%	4.68%	6.01%	2,260	93.78	2,354	2,354	2,102	2,097	87.75	2,185	82.57	3.93%
	Fixed interest	10	7%	4.21%	4.21%	4.68%	6.01%	2,260	93.78	2,354	2,354	1,954	2,049	85.97	2,135	181.19	9.27%
	Fixed interest	25	7%	4.21%	4.21%	4.68%	6.01%	2,260	93.78	2,354	2,354	1,757	2,024	85.05	2,109	352.43	20.06%
Fixed interest	Fixed interest	5	7%	4.21%	4.21%	4.21%	2.41%	2,260	93.78	2,354	2,354	2,624	2,549	104.47	2,653	29.34	1.12%
	Fixed interest	10	7%	4.21%	4.21%	4.21%	2.41%	2,260	93.78	2,354	2,354	2,835	2,549	104.47	2,653	-181.15	-6.39%
	Fixed interest	25	7%	4.21%	4.21%	4.21%	2.41%	2,260	93.78	2,354	2,354	3,283	2,549	104.47	2,653	-629.65	-19.18%
Fixed interest	Fixed interest	5	10%	4.68%	6.01%	4.68%	7.82%	2,097	87.75	2,185	2,185	1,960	1,988	83.71	2,072	111.44	5.68%
	Fixed interest	10	10%	4.68%	6.01%	4.68%	7.82%	2,049	85.97	2,135	2,135	1,797	1,855	78.79	1,934	136.84	7.62%
	Fixed interest	25	10%	4.68%	6.01%	4.68%	7.82%	2,024	85.05	2,109	2,109	1,657	1,832	77.94	1,910	252.75	15.25%
Fixed interest	Fixed interest	5	10%	4.68%	6.01%	4.21%	4.21%	2,097	87.75	2,185	2,185	2,446	2,260	93.78	2,354	-92.45	-3.78%
	Fixed interest	10	10%	4.68%	6.01%	4.21%	4.21%	2,049	85.97	2,135	2,135	2,572	2,260	93.78	2,354	-218.28	-8.69%
	Fixed interest	25	10%	4.68%	6.01%	4.21%	4.21%	2,024	85.05	2,109	2,109	2,826	2,260	93.78	2,354	-472.24	-16.71%
Deposits	Deposits	7%	4.21%	4.21%	10%	4.68%	6.01%	2,260	93.78	2,354	2,354	2,354	2,024	85.05	2,109	-244.73	-10.40%
	Deposits	7%	4.21%	4.21%	4%	2.41%	2.41%	2,260	93.78	2,354	2,354	2,354	2,549	104.47	2,653	299.69	12.73%
	Deposits	10%	4.68%	6.01%	13%	4.68%	7.82%	2,024	85.05	2,109	2,109	2,109	1,832	77.94	1,910	-199.10	-9.44%
Deposits	10%	4.68%	6.01%	7%	4.21%	4.21%	2,024	85.05	2,109	2,109	2,109	2,260	93.78	2,354	244.73	11.60%	

Non profit	25 year Endowment	Male 35 next at entry	Duration 5 years	Sum assured £ 1,000
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[illegible]

Non profit			25 year Endowment			Male 35 next at entry			Duration 15 years			Sum assured £ 1,000													
Table 7.2.15 Tax rate 35%			Solvency 4%			Solvency .003			Zillmer 1.25%																
asset category	asset term	current yield	current i	current g	revised yield	revised i	revised g	current			revised			revised total reserve	amount required of mismatch reserve										
								(1)	(2)	(3)	(4)	(5)	(6)			(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)
Equities		3%	1.80%	1.80%	4%	2.41%	2.41%	626	26.16	652	652	489	585	24.65	610	121	24.64%								
Equities		6%	3.61%	3.61%	8%	4.68%	4.81%	511	21.91	533	533	400	455	19.84	475	75	18.80%								
Fixed interest	5	7%	4.21%	4.21%	10%	4.68%	6.01%	477	20.65	498	498	444	443	19.39	462	18	4.04%								
Fixed interest	10	7%	4.21%	4.21%	10%	4.68%	6.01%	477	20.65	498	498	413	432	18.98	451	38	9.18%								
Fixed interest	25	7%	4.21%	4.21%	10%	4.68%	6.01%	477	20.65	498	498	371	432	18.98	451	80	21.43%								
Fixed interest	5	7%	4.21%	4.21%	4%	2.41%	2.41%	477	20.65	498	498	555	585	24.65	610	55	9.88%								
Fixed interest	10	7%	4.21%	4.21%	4%	2.41%	2.41%	477	20.65	498	498	559	585	24.65	610	10	1.72%								
Fixed interest	25	7%	4.21%	4.21%	4%	2.41%	2.41%	477	20.65	498	498	694	585	24.65	610	-84	-12.17%								
Fixed interest	5	10%	4.68%	6.01%	13%	4.68%	7.82%	443	19.39	462	462	415	426	18.76	445	30	7.20%								
Fixed interest	10	10%	4.68%	6.01%	13%	4.68%	7.82%	432	18.98	451	451	380	401	17.84	419	39	10.34%								
Fixed interest	25	10%	4.68%	6.01%	13%	4.68%	7.82%	432	18.98	451	451	354	401	17.84	419	64	18.19%								
Fixed interest	5	10%	4.68%	6.01%	7%	4.21%	4.21%	443	19.39	462	462	518	477	20.65	498	-20	-3.88%								
Fixed interest	10	10%	4.68%	6.01%	7%	4.21%	4.21%	432	18.98	451	451	543	477	20.65	498	-46	-8.40%								
Fixed interest	25	10%	4.68%	6.01%	7%	4.21%	4.21%	432	18.98	451	451	604	477	20.65	498	-107	-17.65%								
Deposits		7%	4.21%	4.21%	10%	4.68%	6.01%	477	20.65	498	498	498	432	18.98	451	41	-9.38%								
Deposits		7%	4.21%	4.21%	4%	2.41%	2.41%	477	20.65	498	498	498	585	24.65	610	112	22.51%								
Deposits		10%	4.68%	6.01%	13%	4.68%	7.82%	432	18.98	451	451	451	401	17.84	419	-32	-7.13%								
Deposits		10%	4.68%	6.01%	7%	4.21%	4.21%	432	18.98	451	451	451	451	20.65	498	47	10.35%								

Table 7.2.16 Tax rate 35%

asset category	With profit			10 year Endowment			Male 50 next at entry			Duration 5 years			Sum assured £ 1,000			Bonus £ 276		
	Tax rate 35%			Solvency 4%			Solvency .003			Zillmer 2.5%								
	asset term	current yield	current i	current g	revised yield	revised i	revised g	current mathe- matical reserve	current total reserve	current asset value	revised asset value	revised mathe- matical reserve	revised total reserve	revised margin	revised solvency	revised total reserve	amount of mismatch	required reserve
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)		
Equities	3%	1.80%	1.80%	4%	2.41%	2.41%	712	30.17	742	742	557	698	29.65	728	171.03	30.73%		
Equities	6%	3.61%	3.61%	8%	4.68%	4.68%	669	28.56	698	698	523	643	27.62	671	147.43	28.18%		
Fixed interest	5	7%	4.21%	4.21%	10%	4.68%	656	28.10	684	684	611	622	26.84	649	37.87	6.20%		
Fixed interest	10	7%	4.21%	4.21%	10%	4.68%	656	28.10	684	684	588	622	26.84	649	81.00	14.26%		
Fixed interest	25	7%	4.21%	4.21%	10%	4.68%	656	28.10	684	684	511	622	26.84	649	138.30	27.09%		
Fixed interest	5	7%	4.21%	4.21%	4%	2.41%	656	28.10	684	684	763	698	29.65	728	-35.02	-4.59%		
Fixed interest	10	7%	4.21%	4.21%	4%	2.41%	656	28.10	684	684	824	698	29.65	728	-96.20	-11.68%		
Fixed interest	25	7%	4.21%	4.21%	4%	2.41%	656	28.10	684	684	954	698	29.65	728	-226.55	-23.74%		
Fixed interest	5	10%	4.68%	6.01%	13%	4.68%	622	26.84	649	649	582	593	25.77	619	36.59	6.29%		
Fixed interest	10	10%	4.68%	6.01%	13%	4.68%	622	26.84	649	649	546	593	25.77	619	72.65	13.30%		
Fixed interest	25	10%	4.68%	6.01%	13%	4.68%	622	26.84	649	649	510	593	25.77	619	108.94	21.37%		
Fixed interest	5	10%	4.68%	6.01%	7%	4.21%	622	26.84	649	649	726	656	28.10	684	-42.40	-5.84%		
Fixed interest	10	10%	4.68%	6.01%	7%	4.21%	622	26.84	649	649	782	656	28.10	684	-97.58	-12.48%		
Fixed interest	25	10%	4.68%	6.01%	7%	4.21%	622	26.84	649	649	869	656	28.10	684	-185.32	-21.32%		
Deposits	7%	4.21%	4.21%	10%	4.68%	6.01%	656	28.10	684	684	684	622	26.84	649	-35.26	-5.15%		
Deposits	7%	4.21%	4.21%	4%	2.41%	2.41%	656	28.10	684	684	684	698	29.65	728	43.55	6.37%		
Deposits	10%	4.68%	6.01%	13%	4.68%	7.82%	622	26.84	649	649	649	593	25.77	619	-30.07	-4.63%		
Deposits	10%	4.68%	6.01%	7%	4.21%	4.21%	622	26.84	649	649	649	656	28.10	684	35.26	5.43%		

With profit		25 year Endowment		Male 35 next at entry		Duration 5 years		Sum assured £ 1,000		Bonus £ 276							
Table 7.2.17 Tax rate 35%		Solvency 4%		Solvency .003		Zillmer 2.5%											
asset category	asset term	current		revised		current		revised		revised							
		yield i	g	yield i	g	margin reserve	total reserve	asset value	margin reserve	total reserve	amount required						
		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)
Equities		3%	1.80%	1.80%	4%	2.41%	2.41%	344	16.56	361	361	270	312	15.37	327	56.96	21.06%
	Equities	6%	3.61%	3.61%	8%	4.68%	4.81%	258	13.37	271	271	204	214	11.75	226	22.22	10.92%
Fixed interest	5	7%	4.21%	4.21%	10%	4.68%	6.01%	234	12.49	246	246	220	209	11.56	221	.42	.19%
Fixed interest	10	7%	4.21%	4.21%	10%	4.68%	6.01%	234	12.49	246	246	205	203	11.34	214	9.74	4.76%
Fixed interest	25	7%	4.21%	4.21%	10%	4.68%	6.01%	234	12.49	246	246	184	194	11.01	205	21.05	11.45%
Fixed interest	5	7%	4.21%	4.21%	4%	2.41%	2.41%	234	12.49	246	246	275	312	15.37	327	52.58	19.13%
Fixed interest	10	7%	4.21%	4.21%	4%	2.41%	2.41%	234	12.49	246	246	297	312	15.37	327	30.53	10.29%
Fixed interest	25	7%	4.21%	4.21%	4%	2.41%	2.41%	234	12.49	246	246	344	312	15.37	327	-16.43	-4.78%
Fixed interest	5	10%	4.68%	6.01%	13%	4.68%	7.82%	209	11.56	221	221	198	201	11.27	212	14.37	7.26%
Fixed interest	10	10%	4.68%	6.01%	13%	4.68%	7.82%	203	11.34	214	214	180	189	10.82	200	19.42	10.76%
Fixed interest	25	10%	4.68%	6.01%	13%	4.68%	7.82%	194	11.01	205	205	161	172	10.19	182	21.11	13.10%
Fixed interest	5	10%	4.68%	6.01%	7%	4.21%	4.21%	209	11.56	221	221	247	234	12.49	246	-.47	-.19%
Fixed interest	10	10%	4.68%	6.01%	7%	4.21%	4.21%	203	11.34	214	214	258	234	12.49	246	-11.73	-4.54%
Fixed interest	25	10%	4.68%	6.01%	7%	4.21%	4.21%	194	11.01	205	205	275	234	12.49	246	-28.21	-10.27%
Deposits		7%	4.21%	4.21%	10%	4.68%	6.01%	234	12.49	246	246	246	194	11.01	205	-41.48	-16.83%
Deposits		7%	4.21%	4.21%	4%	2.41%	2.41%	234	12.49	246	246	246	312	15.37	327	80.89	32.82%
Deposits		10%	4.68%	6.01%	13%	4.68%	7.82%	194	11.01	205	205	205	172	10.19	182	-22.81	-11.13%
Deposits		10%	4.68%	6.01%	7%	4.21%	4.21%	194	11.01	205	205	205	234	12.49	246	41.48	20.23%

Table 7.2.19		Tax rate 35%		10 year Term Assurance		Male 50 next at entry		Duration 5 years		Sum assured £ 1,000						
		Solvency 4%		Solvency .003		Zillmer .7%										
asset category	asset term	current yield	current i	current g	revised yield	revised i	revised g	current		revised		revised total reserve	revised margin	revised solvency	amount required of mismatch reserve	
								mathe- tical reserve	current margin	mathe- tical reserve	current margin					
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)
Equities		3%	1.80%	1.80%	4%	2.41%	2.41%	14	3.52	18	18	13	14	3.52	18	4.38 33.33%
		6%	3.61%	3.61%	8%	4.68%	4.81%	13	3.48	16	16	12	12	3.44	15	3.08 24.94%
Fixed interest	5	7%	4.21%	4.21%	10%	4.68%	6.01%	13	3.48	16	16	15	12	3.44	15	.72 4.92%
	10	7%	4.21%	4.21%	10%	4.68%	6.01%	13	3.48	16	16	14	12	3.44	15	1.76 12.89%
Fixed interest	25	7%	4.21%	4.21%	10%	4.68%	6.01%	13	3.48	16	16	12	12	3.44	15	3.14 25.56%
Fixed interest	5	7%	4.21%	4.21%	4%	2.41%	2.41%	13	3.48	16	16	18	14	3.52	18	-.86 -4.66%
	10	7%	4.21%	4.21%	4%	2.41%	2.41%	13	3.48	16	16	20	14	3.52	18	-2.33 -11.74%
Fixed interest	25	7%	4.21%	4.21%	4%	2.41%	2.41%	13	3.48	16	16	23	14	3.52	18	-5.47 -23.80%
Fixed interest	5	10%	4.68%	6.01%	13%	4.68%	7.82%	12	3.44	15	15	14	11	3.41	14	.55 3.97%
	10	10%	4.68%	6.01%	13%	4.68%	7.82%	12	3.44	15	15	13	11	3.41	14	1.41 10.83%
Fixed interest	25	10%	4.68%	6.01%	13%	4.68%	7.82%	12	3.44	15	15	12	11	3.41	14	2.27 18.72%
Fixed interest	5	10%	4.68%	6.01%	7%	4.21%	4.21%	12	3.44	15	15	17	13	3.48	16	-.81 -4.69%
	10	10%	4.68%	6.01%	7%	4.21%	4.21%	12	3.44	15	15	19	13	3.48	16	-2.12 -11.42%
Fixed interest	25	10%	4.68%	6.01%	7%	4.21%	4.21%	12	3.44	15	15	21	13	3.48	16	-4.21 -20.36%
Deposits		7%	4.21%	4.21%	10%	4.68%	6.01%	13	3.48	16	16	16	12	3.44	15	-1.04 -6.29%
Deposits		7%	4.21%	4.21%	4%	2.41%	2.41%	13	3.48	16	16	16	14	3.52	18	1.04 6.29%
Deposits		10%	4.68%	6.01%	13%	4.68%	7.82%	12	3.44	15	15	15	11	3.41	14	-1.04 -6.71%
Deposits		10%	4.68%	6.01%	7%	4.21%	4.21%	12	3.44	15	15	15	13	3.48	16	1.04 6.71%

Table 7.2.20 Tax rate 35%																				
25 year Term Assurance				Male 35 next at entry				Duration 5 years				Sum assured £ 1,000								
				Solvency 4%				Solvency .003				Zillmer .3%								
asset category	term	asset yield	current yield	current i	current g	revised yield	revised i	revised g	current			revised			revised total reserve	revised margin	amount required of mismatch reserve			
									mathematical reserve	solvency margin	total reserve	current asset value	revised asset value	mathematical reserve				solvency margin	total reserve	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)				
Equities		3%	1.80%	1.80%	4%	2.41%	2.41%	32	4.18	36	36	27	28	4.04	32	4.90 18.05%				
Equities		6%	3.61%	3.61%	8%	4.68%	4.81%	22	3.81	26	26	19	18	3.67	22	2.31 11.91%				
Fixed interest	5	7%	4.21%	4.21%	10%	4.68%	6.01%	20	3.74	24	24	21	17	3.63	21	-57 -2.70%				
Fixed interest	10	7%	4.21%	4.21%	10%	4.68%	6.01%	20	3.74	24	24	20	16	3.59	20	-11 -.58%				
Fixed interest	25	7%	4.21%	4.21%	10%	4.68%	6.01%	20	3.74	24	24	18	15	3.56	19	.84 4.73%				
Fixed interest	5	7%	4.21%	4.21%	4%	2.41%	2.41%	20	3.74	24	24	26	28	4.04	32	5.57 21.04%				
Fixed interest	10	7%	4.21%	4.21%	4%	2.41%	2.41%	20	3.74	24	24	29	28	4.04	32	3.45 12.05%				
Fixed interest	25	7%	4.21%	4.21%	4%	2.41%	2.41%	20	3.74	24	24	33	28	4.04	32	-1.08 -3.25%				
Fixed interest	5	10%	4.68%	6.01%	13%	4.68%	7.82%	17	3.63	21	21	19	16	3.59	20	1.08 5.85%				
Fixed interest	10	10%	4.68%	6.01%	13%	4.68%	7.82%	16	3.59	20	20	16	15	3.56	19	2.06 12.52%				
Fixed interest	25	10%	4.68%	6.01%	13%	4.68%	7.82%	15	3.56	19	19	15	13	3.48	16	1.90 13.04%				
Fixed interest	5	10%	4.68%	6.01%	7%	4.21%	4.21%	17	3.63	21	21	23	20	3.74	24	.64 2.78%				
Fixed interest	10	10%	4.68%	6.01%	7%	4.21%	4.21%	16	3.59	20	20	24	20	3.74	24	-14 -.58%				
Fixed interest	25	10%	4.68%	6.01%	7%	4.21%	4.21%	15	3.56	19	19	25	20	3.74	24	-1.12 -4.52%				
Deposits		7%	4.21%	4.21%	10%	4.68%	6.01%	20	3.74	24	24	24	15	3.56	19	-5.19 -21.84%				
Deposits		10%	4.68%	5.83%	4%	2.41%	2.41%	20	3.74	24	24	24	28	4.04	32	8.30 34.95%				
Deposits		10%	4.68%	6.01%	13%	4.68%	7.82%	15	3.56	19	19	19	13	3.48	16	-2.07 -11.18%				
Deposits		10%	4.68%	6.01%	7%	4.21%	4.21%	15	3.56	19	19	19	20	3.74	24	5.19 27.94%				

Immediate Annuity				Male age 60				Annuity £100 payable yearly in advance											
Table 7.2.22				Solvency		4%		No death strain		Single Premium									

Immediate Annuity			Male age 60			Annuity £100 payable yearly in advance escalating at 5%											
			Solvency		4%	No death strain											
asset category	term	current yield	current i	current g	revised yield	revised i	revised g	current mathe- tical reserve	current margin	current total reserve	current asset value	revised asset value	revised mathe- tical reserve	revised margin	revised total reserve	amount of mismatch	required reserve
Equities		3%	2.78%	2.78%	4%	3.70%	3.70%	2,559	102.36	2,661	2,661	1,996	2,281	91.24	2,372	376.22	18.85%
	Equities	6%	5.55%	5.55%	8%	7.20%	7.40%	1,849	73.96	1,923	1,923	1,442	1,537	61.48	1,598	156.26	10.83%
Fixed interest	5	7%	6.48%	6.48%	10%	7.20%	9.25%	1,680	67.20	1,747	1,747	1,560	1,450	58.00	1,508	-52.44	-3.36%
Fixed interest	10	7%	6.48%	6.48%	10%	7.20%	9.25%	1,680	67.20	1,747	1,747	1,450	1,379	55.16	1,434	-16.12	-1.11%
Fixed interest	25	7%	6.48%	6.48%	10%	7.20%	9.25%	1,680	67.20	1,747	1,747	1,304	1,309	52.36	1,361	57.43	4.40%
Fixed interest	5	7%	6.48%	6.48%	4%	3.70%	3.70%	1,680	67.20	1,747	1,747	1,948	2,281	91.24	2,372	424.36	21.79%
Fixed interest	10	7%	6.48%	6.48%	4%	3.70%	3.70%	1,680	67.20	1,747	1,747	2,104	2,281	91.24	2,372	268.11	12.74%
Fixed interest	25	7%	6.48%	6.48%	4%	3.70%	3.70%	1,680	67.20	1,747	1,747	2,437	2,281	91.24	2,372	-64.81	-2.66%
Fixed interest	5	10%	7.20%	9.25%	13%	7.20%	12.03%	1,450	58.00	1,508	1,508	1,353	1,311	52.44	1,363	10.38	.77%
Fixed interest	10	10%	7.20%	9.25%	13%	7.20%	12.03%	1,379	55.16	1,434	1,434	1,207	1,173	46.92	1,220	12.82	1.06%
Fixed interest	25	10%	7.20%	9.25%	13%	7.20%	12.03%	1,309	52.36	1,361	1,361	1,070	1,061	42.44	1,103	33.74	3.15%
Fixed interest	5	10%	7.20%	9.25%	7%	6.48%	6.48%	1,450	58.00	1,508	1,508	1,588	1,680	67.20	1,747	58.71	3.48%
Fixed interest	10	10%	7.20%	9.25%	7%	6.48%	6.48%	1,379	55.16	1,434	1,434	1,728	1,680	67.20	1,747	19.43	1.12%
Fixed interest	25	10%	7.20%	9.25%	7%	6.48%	6.48%	1,309	52.36	1,361	1,361	1,824	1,680	67.20	1,747	-76.96	-4.22%
Deposits		7%	6.48%	6.48%	10%	7.20%	9.25%	1,680	67.20	1,747	1,747	1,747	1,305	52.20	1,357	-390.00	-22.32%
Deposits		7%	6.48%	6.48%	4%	3.70%	3.70%	1,680	67.20	1,747	1,747	1,747	2,281	91.24	2,372	625.04	35.77%
Deposits		10%	7.20%	9.25%	13%	7.20%	12.03%	1,305	52.20	1,357	1,357	1,357	1,057	42.28	1,099	-257.92	-19.00%
Deposits		10%	7.20%	9.25%	7%	6.48%	6.48%	1,305	52.20	1,357	1,357	1,357	1,680	67.20	1,747	390.00	28.74%

Immediate Annuity			Male age 80			Annuity £100 payable yearly in advance												
Table 7.2.24			Solvency			4%			No death strain			Single Premium						

Table 7.2.25 Annuity £100 payable yearly in advance escalating at 5%

asset category	Immediate Annuity			Male age 80			Single Premium									
	Solvency			4%			No death strain									
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)
asset category	asset term	current yield	current yield	revised yield	revised yield	revised yield	current mathematical reserve	current mathematical reserve	current total reserve	current asset value	revised asset value	revised mathematical reserve	revised mathematical reserve	revised total reserve	amount of mismatch	required reserve
Equities		3%	2.78%	2.78%	4%	3.70%	3.70%	884	35.36	919	690	841	33.64	875	185.12	26.85%
Equities		6%	5.55%	5.55%	8%	7.20%	7.40%	768	30.72	799	599	705	28.20	733	134.16	22.40%
Fixed interest	5	7%	6.48%	6.48%	10%	7.20%	9.25%	735	29.40	764	683	671	26.84	698	15.15	2.22%
Fixed interest	10	7%	6.48%	6.48%	10%	7.20%	9.25%	735	29.40	764	634	657	26.28	683	48.78	7.69%
Fixed interest	25	7%	6.48%	6.48%	10%	7.20%	9.25%	735	29.40	764	570	653	26.12	679	108.65	19.05%
Fixed interest	5	7%	6.48%	6.48%	4%	3.70%	3.70%	735	29.40	764	852	841	33.64	875	22.44	2.63%
Fixed interest	10	7%	6.48%	6.48%	4%	3.70%	3.70%	735	29.40	764	921	841	33.64	875	-45.92	-4.99%
Fixed interest	25	7%	6.48%	6.48%	4%	3.70%	3.70%	735	29.40	764	1,066	841	33.64	875	-191.57	-17.97%
Fixed interest	5	10%	7.20%	9.25%	13%	7.20%	12.03%	671	26.84	698	626	621	24.84	646	19.70	3.15%
Fixed interest	10	10%	7.20%	9.25%	13%	7.20%	12.03%	657	26.28	683	575	594	23.76	618	42.66	7.42%
Fixed interest	25	10%	7.20%	9.25%	13%	7.20%	12.03%	653	26.12	679	534	587	23.48	610	76.86	14.40%
Fixed interest	5	10%	7.20%	9.25%	7%	6.48%	6.48%	671	26.84	698	781	735	29.40	764	-16.96	-2.17%
Fixed interest	10	10%	7.20%	9.25%	7%	6.48%	6.48%	657	26.28	683	823	735	29.40	764	-58.77	-7.14%
Fixed interest	25	10%	7.20%	9.25%	7%	6.48%	6.48%	653	26.12	679	910	735	29.40	764	-145.59	-16.00%
Deposits		7%	6.48%	6.48%	10%	7.20%	9.25%	735	29.40	764	764	653	26.12	679	-85.28	-11.16%
Deposits		7%	6.48%	6.48%	4%	3.70%	3.70%	735	29.40	764	764	841	33.64	875	110.24	14.42%
Deposits		10%	7.20%	9.25%	13%	7.20%	12.03%	653	26.12	679	679	587	23.48	610	-68.64	-10.11%
Deposits		10%	7.20%	9.25%	7%	6.48%	6.48%	653	26.12	679	679	735	29.40	764	85.28	12.56%

Deferred Annuity to age 65		Male 40 next at entry				Duration 5 years				Gt'd Cash Option £ 1,000				Non-profit			
Table 7.2.26		Solvency 4%		No death strain		Zillmer 3.5%		Single Premium									
asset category	asset term	current yield i	current g	revised yield i	revised g	current			revised			revised total reserve	revised solvency margin	revised mismatch reserve	amount required of mismatch		
						mathe- matical reserve	current margin	total value	current asset value	revised asset value	mathe- matical reserve					revised solvency margin	
		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)
Equities		3%	2.78%	2.78%	4%	3.70%	3.70%	578	23.12	601	601	451	484	19.36	503	52.52	11.65%
		6%	5.55%	5.55%	8%	7.20%	7.40%	339	13.56	353	353	264	244	9.76	254	-10.66	-4.03%
Fixed interest	5	7%	6.48%	6.48%	10%	7.20%	9.25%	285	11.40	296	296	265	232	9.28	241	-23.44	-8.85%
Fixed interest	10	7%	6.48%	6.48%	10%	7.20%	9.25%	285	11.40	296	296	246	220	8.80	229	-17.23	-7.00%
Fixed interest	25	7%	6.48%	6.48%	10%	7.20%	9.25%	285	11.40	296	296	221	205	8.20	213	-8.00	-3.62%
Fixed interest	5	7%	6.48%	6.48%	4%	3.70%	3.70%	285	11.40	296	296	330	484	19.36	503	172.92	52.33%
Fixed interest	10	7%	6.48%	6.48%	4%	3.70%	3.70%	285	11.40	296	296	357	484	19.36	503	146.41	41.02%
Fixed interest	25	7%	6.48%	6.48%	4%	3.70%	3.70%	285	11.40	296	296	413	484	19.36	503	89.93	21.75%
Fixed interest	5	10%	7.20%	9.25%	13%	7.20%	12.03%	232	9.28	241	241	215	216	8.64	225	8.15	3.76%
Fixed interest	10	10%	7.20%	9.25%	13%	7.20%	12.03%	220	8.80	229	229	193	193	7.72	201	8.14	4.23%
Fixed interest	25	10%	7.20%	9.25%	13%	7.20%	12.03%	205	8.20	213	213	168	166	6.64	173	5.12	3.05%
Fixed interest	5	10%	7.20%	9.25%	7%	6.48%	6.48%	232	9.28	241	241	270	285	11.40	296	26.24	9.71%
Fixed interest	10	10%	7.20%	9.25%	7%	6.48%	6.48%	220	8.80	229	229	276	285	11.40	296	20.76	7.53%
Fixed interest	25	10%	7.20%	9.25%	7%	6.48%	6.48%	205	8.20	213	213	286	285	11.40	296	10.72	3.75%
Deposits		7%	6.48%	6.48%	10%	7.20%	9.25%	285	11.40	296	296	296	205	8.20	213	-83.20	-28.07%
Deposits		7%	6.48%	6.48%	4%	3.70%	3.70%	285	11.40	296	296	296	484	19.36	503	206.96	69.82%
Deposits		10%	7.20%	9.25%	13%	7.20%	12.03%	205	8.20	213	213	213	166	6.64	173	-40.56	-19.02%
Deposits		10%	7.20%	9.25%	7%	6.48%	6.48%	205	8.20	213	213	213	285	11.40	296	83.20	39.02%

Table 7.2.27																	
Deferred Annuity to age 65				Male 40 next at entry			Duration 15 years			Gt'd Cash Option £ 1,000			Non-profit				
asset category	asset term	Solvency 4%			No death strain			Zillmer 3.5%			Single Premium			revised total reserve	revised margin	amount of mismatch reserve	
		current yield	current i	revised yield	revised i	revised g	current mathe- tical solvency reserve	current total reserve	current asset value	revised asset value	revised mathe- tical solvency reserve	revised margin					
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)		
Equities		3%	2.78%	2.78%	4%	3.70%	3.70%	760	30.40	790	790	593	695	27.80	723	130.00	21.93%
Equities		6%	5.55%	5.55%	8%	7.20%	7.40%	583	23.32	606	606	455	492	19.68	512	56.94	12.52%
Fixed interest	5	7%	6.48%	6.48%	10%	7.20%	9.25%	534	21.36	555	555	496	462	18.48	480	-15.52	-3.13%
Fixed interest	10	7%	6.48%	6.48%	10%	7.20%	9.25%	534	21.36	555	555	461	437	17.48	454	-6.50	-1.41%
Fixed interest	25	7%	6.48%	6.48%	10%	7.20%	9.25%	534	21.36	555	555	414	437	17.48	454	40.02	9.66%
Fixed interest	5	7%	6.48%	6.48%	4%	3.70%	3.70%	534	21.36	555	555	619	695	27.80	723	103.65	16.74%
Fixed interest	10	7%	6.48%	6.48%	4%	3.70%	3.70%	534	21.36	555	555	669	695	27.80	723	53.99	8.07%
Fixed interest	25	7%	6.48%	6.48%	4%	3.70%	3.70%	534	21.36	555	555	775	695	27.80	723	-51.83	-6.69%
Fixed interest	5	10%	7.20%	9.25%	13%	7.20%	12.03%	462	18.48	480	480	431	425	17.00	442	10.89	2.53%
Fixed interest	10	10%	7.20%	9.25%	13%	7.20%	12.03%	437	17.48	454	454	383	373	14.92	388	5.40	1.41%
Fixed interest	25	10%	7.20%	9.25%	13%	7.20%	12.03%	437	17.48	454	454	357	373	14.92	388	30.81	8.63%
Fixed interest	5	10%	7.20%	9.25%	7%	6.48%	6.48%	462	18.48	480	480	538	534	21.36	555	17.37	3.23%
Fixed interest	10	10%	7.20%	9.25%	7%	6.48%	6.48%	437	17.48	454	454	548	534	21.36	555	7.83	1.43%
Fixed interest	25	10%	7.20%	9.25%	7%	6.48%	6.48%	437	17.48	454	454	609	534	21.36	555	-53.62	-8.81%
Deposits		7%	6.48%	6.48%	10%	7.20%	9.25%	534	21.36	555	555	555	437	17.48	454	-100.88	-18.16%
Deposits		7%	6.48%	6.48%	4%	3.70%	3.70%	534	21.36	555	555	555	695	27.80	723	167.44	30.15%
Deposits		10%	7.20%	9.25%	13%	7.20%	12.03%	437	17.48	454	454	454	454	14.92	388	-66.56	-14.65%
Deposits		10%	7.20%	9.25%	7%	6.48%	6.48%	437	17.48	454	454	454	534	21.36	555	100.88	22.20%

Deferred Annuity to age 65																	Gt'd Cash Option £ 1,000			Bonus £ 403	
Table 7.2.28																					
asset category	asset term	Solvency 4%					Male 40 next at entry					Duration 5 years					Annual Premium				
							No death strain					Zillmer 3.5%									
							current					current					revised				
		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)				
		current yield	current i	current g	revised yield	revised i	revised g	mathe- reserve	current mathe- solvency margin	current total reserve	current asset value	revised asset value	revised mathe- reserve	revised solvency margin	revised total reserve	amount required of mismatch					
Equities		3%	2.78%	2.78%	4%	3.70%	3.70%	352	14.08	366	366	275	299	11.96	311	36.40	13.26%				
Equities		6%	5.55%	5.55%	8%	7.20%	7.40%	214	8.56	223	223	167	155	6.20	161	-5.72	-3.43%				
Fixed interest	5	7%	6.48%	6.48%	10%	7.20%	9.25%	180	7.20	187	187	167	149	5.96	155	-12.23	-7.31%				
Fixed interest	10	7%	6.48%	6.48%	10%	7.20%	9.25%	180	7.20	187	187	155	143	5.72	149	-6.67	-4.29%				
Fixed interest	25	7%	6.48%	6.48%	10%	7.20%	9.25%	180	7.20	187	187	140	137	5.48	142	2.77	1.99%				
Fixed interest	5	7%	6.48%	6.48%	4%	3.70%	3.70%	180	7.20	187	187	209	233	9.32	242	33.62	16.11%				
Fixed interest	10	7%	6.48%	6.48%	4%	3.70%	3.70%	180	7.20	187	187	225	233	9.32	242	16.88	7.49%				
Fixed interest	25	7%	6.48%	6.48%	4%	3.70%	3.70%	180	7.20	187	187	261	233	9.32	242	-18.79	-7.20%				
Fixed interest	5	10%	7.20%	9.25%	13%	7.20%	12.03%	149	5.96	155	155	139	142	5.68	148	8.64	6.22%				
Fixed interest	10	10%	7.20%	9.25%	13%	7.20%	12.03%	143	5.72	149	149	125	131	5.24	136	11.07	8.84%				
Fixed interest	25	10%	7.20%	9.25%	13%	7.20%	12.03%	137	5.48	142	142	112	118	4.72	123	10.77	9.62%				
Fixed interest	5	10%	7.20%	9.25%	7%	6.48%	6.48%	149	5.96	155	155	174	180	7.20	187	13.69	7.89%				
Fixed interest	10	10%	7.20%	9.25%	7%	6.48%	6.48%	143	5.72	149	149	179	180	7.20	187	8.03	4.48%				
Fixed interest	25	10%	7.20%	9.25%	7%	6.48%	6.48%	137	5.48	142	142	191	180	7.20	187	-3.72	-1.95%				
Deposits		7%	6.48%	6.48%	10%	7.20%	9.25%	180	7.20	187	187	187	137	5.48	142	-44.72	-23.89%				
Deposits		7%	6.48%	6.48%	4%	3.70%	3.70%	180	7.20	187	187	187	233	9.32	242	55.12	29.44%				
Deposits		10%	7.20%	9.25%	13%	7.20%	12.03%	137	5.48	142	142	142	118	4.72	123	-19.76	-13.87%				
Deposits		10%	7.20%	9.25%	7%	6.48%	6.48%	137	5.48	142	142	142	180	7.20	187	44.72	31.39%				

Deferred Annuity to age 65			Male 40 next at entry			Duration 5 years			Gt'd Cash Option £ 1,000			Bonus £ 403																		
Table 7.2.30			Solvency 4%			No death strain			Zillmer 3.5%			Single Premium																		
asset category	asset term	current yield	current i	revised yield	revised i	current			revised			revised total reserve	mathe- matical reserve	revised asset value	current asset value	margin solvency	revised margin solvency	total reserve	revised total reserve	amount required of mismatch										
						(1)	(2)	(3)	(4)	(5)	(6)										(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)
Equities		3%	2.78%	2.78%	4%	3.70%	3.70%	810	32.40	842	842	632	678	27.12	705	73.32	11.60%													
Equities		6%	5.55%	5.55%	8%	7.20%	7.40%	476	19.04	495	495	371	342	13.68	356	-15.60	-4.20%													
Fixed interest	5	7%	6.48%	6.48%	10%	7.20%	9.25%	400	16.00	416	416	372	325	13.00	338	-33.53	-9.03%													
Fixed interest	10	7%	6.48%	6.48%	10%	7.20%	9.25%	400	16.00	416	416	345	308	12.32	320	-24.99	-7.24%													
Fixed interest	25	7%	6.48%	6.48%	10%	7.20%	9.25%	400	16.00	416	416	310	288	11.52	300	-10.94	-3.52%													
Fixed interest	5	7%	6.48%	6.48%	4%	3.70%	3.70%	400	16.00	416	416	464	678	27.12	705	241.34	52.04%													
Fixed interest	10	7%	6.48%	6.48%	4%	3.70%	3.70%	400	16.00	416	416	501	678	27.12	705	204.14	40.75%													
Fixed interest	25	7%	6.48%	6.48%	4%	3.70%	3.70%	400	16.00	416	416	580	678	27.12	705	124.87	21.52%													
Fixed interest	5	10%	7.20%	9.25%	13%	7.20%	12.03%	325	13.00	338	338	303	303	12.12	315	11.86	3.91%													
Fixed interest	10	10%	7.20%	9.25%	13%	7.20%	12.03%	308	12.32	320	320	270	271	10.84	282	12.23	4.54%													
Fixed interest	25	10%	7.20%	9.25%	13%	7.20%	12.03%	288	11.52	300	300	235	232	9.28	241	5.93	2.52%													
Fixed interest	5	10%	7.20%	9.25%	7%	6.48%	6.48%	325	13.00	338	338	378	400	16.00	416	37.55	9.92%													
Fixed interest	10	10%	7.20%	9.25%	7%	6.48%	6.48%	308	12.32	320	320	386	400	16.00	416	30.10	7.80%													
Fixed interest	25	10%	7.20%	9.25%	7%	6.48%	6.48%	288	11.52	300	300	401	400	16.00	416	14.66	3.65%													
Deposits		7%	6.48%	6.48%	10%	7.20%	9.25%	400	16.00	416	416	416	288	11.52	300	-116.48	-28.00%													
Deposits		7%	6.48%	6.48%	4%	3.70%	3.70%	400	16.00	416	416	416	678	27.12	705	289.12	69.50%													
Deposits		10%	7.20%	9.25%	13%	7.20%	12.03%	288	11.52	300	300	300	232	9.28	241	-58.24	-19.44%													
Deposits		10%	7.20%	9.25%	7%	6.48%	6.48%	288	11.52	300	300	300	400	16.00	416	116.48	38.89%													

Deferred Annuity to age 65										Gt'd Cash Option £ 1,000				Bonus £ 1,759			
Table 7.2.31										Single Premium							
asset category	asset term	Solvency 4%		Male 40 next at entry		Duration 15 years		3.5%									
		No death strain		Zillmer													
		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)
		current yield	current i	current g	revised yield	revised i	revised g	current mathe- netical reserve	current solvency margin	current total reserve	current asset value	revised asset value	revised mathe- netical reserve	revised solvency margin	revised total reserve	amount of mismatch	required reserve
Equities		3%	2.78%	2.78%	4%	3.70%	3.70%	2,097	83.88	2,181	2,181	1,636	1,919	76.76	1,996	360.10	22.02%
Equities		6%	5.55%	5.55%	8%	7.20%	7.40%	1,608	64.32	1,672	1,672	1,254	1,358	54.32	1,412	158.08	12.60%
Fixed interest	5	7%	6.48%	6.48%	10%	7.20%	9.25%	1,473	58.92	1,532	1,532	1,368	1,276	51.04	1,327	-41.13	-3.01%
Fixed interest	10	7%	6.48%	6.48%	10%	7.20%	9.25%	1,473	58.92	1,532	1,532	1,272	1,205	48.20	1,253	-18.39	-1.45%
Fixed interest	25	7%	6.48%	6.48%	10%	7.20%	9.25%	1,473	58.92	1,532	1,532	1,143	1,205	48.20	1,253	109.94	9.62%
Fixed interest	5	7%	6.48%	6.48%	4%	3.70%	3.70%	1,473	58.92	1,532	1,532	1,708	1,919	76.76	1,996	287.89	16.86%
Fixed interest	10	7%	6.48%	6.48%	4%	3.70%	3.70%	1,473	58.92	1,532	1,532	1,845	1,919	76.76	1,996	150.89	8.18%
Fixed interest	25	7%	6.48%	6.48%	4%	3.70%	3.70%	1,473	58.92	1,532	1,532	2,137	1,919	76.76	1,996	-141.01	-6.60%
Fixed interest	5	10%	7.20%	9.25%	13%	7.20%	12.03%	1,276	51.04	1,327	1,327	1,191	1,174	46.96	1,221	30.27	2.54%
Fixed interest	10	10%	7.20%	9.25%	13%	7.20%	12.03%	1,205	48.20	1,253	1,253	1,055	1,030	41.20	1,071	16.41	1.56%
Fixed interest	25	10%	7.20%	9.25%	13%	7.20%	12.03%	1,205	48.20	1,253	1,253	985	1,030	41.20	1,071	86.49	8.78%
Fixed interest	5	10%	7.20%	9.25%	7%	6.48%	6.48%	1,276	51.04	1,327	1,327	1,486	1,473	58.92	1,532	46.05	3.10%
Fixed interest	10	10%	7.20%	9.25%	7%	6.48%	6.48%	1,205	48.20	1,253	1,253	1,510	1,473	58.92	1,532	22.15	1.47%
Fixed interest	25	10%	7.20%	9.25%	7%	6.48%	6.48%	1,205	48.20	1,253	1,253	1,679	1,473	58.92	1,532	-147.31	-8.77%
Deposits		7%	6.48%	6.48%	10%	7.20%	9.25%	1,473	58.92	1,532	1,532	1,532	1,205	48.20	1,253	-278.72	-18.19%
Deposits		7%	6.48%	6.48%	4%	3.70%	3.70%	1,473	58.92	1,532	1,532	1,532	1,919	76.76	1,996	463.84	30.28%
Deposits		10%	7.20%	9.25%	13%	7.20%	12.03%	1,205	48.20	1,253	1,253	1,253	1,030	41.20	1,071	-182.00	-14.52%
Deposits		10%	7.20%	9.25%	7%	6.48%	6.48%	1,205	48.20	1,253	1,253	1,253	1,473	58.92	1,532	278.72	22.24%

Fixed Liability of £100

Table 7.2.32 Tax rate N/A Solvency 0%

asset category	asset term	current yield	revised yield	current			(3)	current			(7)	revised asset value	(8)	(9)	revised total reserve	(10)	(11)	(12)
				margin	solvency	reserve		margin	solvency	reserve								
Equities		3%	4%				100	0	100	100	75	100	0	100	0	100	25.00	33.33%
	Equities	6%	8%				100	0	100	100	75	100	0	100	0	100	25.00	33.33%
Fixed interest	5	7%	10%				100	0	100	100	89	100	0	100	0	100	10.69	11.97%
	10	7%	10%				100	0	100	100	83	100	0	100	0	100	16.99	20.47%
	25	7%	10%				100	0	100	100	75	100	0	100	0	100	25.37	34.00%
Fixed interest	5	7%	4%				100	0	100	100	111	100	0	100	0	100	-11.49	-10.30%
	10	7%	4%				100	0	100	100	120	100	0	100	0	100	-20.43	-16.96%
	25	7%	4%				100	0	100	100	139	100	0	100	0	100	-39.48	-28.31%
Fixed interest	5	10%	13%				100	0	100	100	90	100	0	100	0	100	10.27	11.45%
	10	10%	13%				100	0	100	100	84	100	0	100	0	100	15.83	18.81%
	25	10%	13%				100	0	100	100	79	100	0	100	0	100	21.42	27.27%
Fixed interest	5	10%	7%				100	0	100	100	112	100	0	100	0	100	-11.97	-10.69%
	10	10%	7%				100	0	100	100	120	100	0	100	0	100	-20.47	-16.99%
	25	10%	7%				100	0	100	100	134	100	0	100	0	100	-34.00	-25.37%
Deposits		7%	10%				100	0	100	100	100	100	0	100	0	100	.00	0%
Deposits		7%	4%				100	0	100	100	100	100	0	100	0	100	.00	0%
Deposits		10%	13%				100	0	100	100	100	100	0	100	0	100	.00	0%
Deposits		10%	7%				100	0	100	100	100	100	0	100	0	100	.00	0%

Capital Gains Tax reserve for LAF fund

Capital Gains Tax reserve for LAF fund				30% unrealised appreciation											
Table 7.2.33				Tax rate 35%				Solvency 0%				25% reduction in equity asset			
asset category	asset term	current yield	revised yield	purchase price	equity asset market value	equity asset for reserve change	CGT rate	equity asset value	current CGT reserve	revised asset value	CGT reserve value	revised amount	CGT reserve	amount of mismatch	required reserve
Equities		3%	4%		1,000	1,300	20%	25%	60	60	45	0	-45.00	-100%	
Equities		6%	8%		1,000	1,300	20%	25%	60	60	45	0	-45.00	-100%	
Fixed Interest	5	7%	10%		1,000	1,300	20%	25%	60	60	54	0	-53.59	-100%	
Fixed Interest	10	7%	10%		1,000	1,300	20%	25%	60	60	50	0	-49.80	-100%	
Fixed Interest	25	7%	10%		1,000	1,300	20%	25%	60	60	45	0	-44.78	-100%	
Fixed Interest	5	7%	4%		1,000	1,300	20%	25%	60	60	67	0	-66.89	-100%	
Fixed Interest	10	7%	4%		1,000	1,300	20%	25%	60	60	72	0	-72.26	-100%	
Fixed Interest	25	7%	4%		1,000	1,300	20%	25%	60	60	84	0	-83.69	-100%	
Fixed Interest	5	10%	13%		1,000	1,300	20%	25%	60	60	54	0	-53.84	-100%	
Fixed Interest	10	10%	13%		1,000	1,300	20%	25%	60	60	51	0	-50.50	-100%	
Fixed Interest	25	10%	13%		1,000	1,300	20%	25%	60	60	47	0	-47.15	-100%	
Fixed Interest	5	10%	7%		1,000	1,300	20%	25%	60	60	67	0	-67.18	-100%	
Fixed Interest	10	10%	7%		1,000	1,300	20%	25%	60	60	72	0	-72.28	-100%	
Fixed Interest	25	10%	7%		1,000	1,300	20%	25%	60	60	80	0	-80.40	-100%	
Deposits		7%	10%		1,000	1,300	20%	25%	60	60	60	0	-60.00	-100%	
Deposits		7%	4%		1,000	1,300	20%	25%	60	60	60	0	-60.00	-100%	
Deposits		10%	13%		1,000	1,300	20%	25%	60	60	60	0	-60.00	-100%	
Deposits		10%	7%		1,000	1,300	20%	25%	60	60	60	0	-60.00	-100%	

(3) after adjustment for indexation allowance

Capital Gains Tax reserve for IAN fund

30% unrealised appreciation

Table 7.2.34 Tax rate 35%				Solvency 0%		nil reduction in equity asset							
asset category	asset term	current yield	revised yield	equity asset purchase price	equity asset market value	CGT rate for reserve change	CGT asset value	current asset value	revised asset value	CGT reserve	revised reserve	amount of mismatch	required reserve
				(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
not applicable													
Equities													
Fixed interest	5	7%	10%	1,000	1,300	20%	0%	60	60	54	60	6.41	11.97%
Fixed interest	10	7%	10%	1,000	1,300	20%	0%	60	60	50	60	10.20	20.47%
Fixed interest	25	7%	10%	1,000	1,300	20%	0%	60	60	45	60	15.22	34.00%
Fixed interest	5	7%	4%	1,000	1,300	20%	0%	60	60	67	60	-6.89	-10.30%
Fixed interest	10	7%	4%	1,000	1,300	20%	0%	60	60	72	60	-12.26	-16.96%
Fixed interest	25	7%	4%	1,000	1,300	20%	0%	60	60	84	60	-23.69	-28.31%
Fixed interest	5	10%	13%	1,000	1,300	20%	0%	60	60	54	60	6.16	11.45%
Fixed interest	10	10%	13%	1,000	1,300	20%	0%	60	60	51	60	9.50	18.81%
Fixed interest	25	10%	13%	1,000	1,300	20%	0%	60	60	47	60	12.85	27.27%
Fixed interest	5	10%	7%	1,000	1,300	20%	0%	60	60	67	60	-7.18	-10.69%
Fixed interest	10	10%	7%	1,000	1,300	20%	0%	60	60	72	60	-12.28	-16.99%
Fixed interest	25	10%	7%	1,000	1,300	20%	0%	60	60	80	60	-20.40	-25.37%
Deposits		7%	10%	1,000	1,300	20%	0%	60	60	60	60	.00	0%
Deposits		7%	4%	1,000	1,300	20%	0%	60	60	60	60	.00	0%
Deposits		10%	13%	1,000	1,300	20%	0%	60	60	60	60	.00	0%
Deposits		10%	7%	1,000	1,300	20%	0%	60	60	60	60	.00	0%

(3) after adjustment for indexation allowance

Capital Gains Tax reserve for LAF fund

100% unrealised appreciation

Table 7.2.35 Tax rate 35% Solvency 0% 25% reduction in equity asset

asset category	asset term	current yield	revised yield	equity asset purchase price		equity asset market value		CGT rate for reserve change	equity asset value		current CGT reserve	revised asset value	revised CGT reserve	amount required of mismatch reserve
				(1)	(2)	(3)	(4)		(5)	(6)				
Equities	Equities	3%	4%	1,000	2,000	20%	25%	200	200	150	100	-50.00	-33.33%	
		6%	8%	1,000	2,000	20%	25%	200	200	150	100	-50.00	-33.33%	
Fixed interest	5	7%	10%	1,000	2,000	20%	25%	200	200	179	100	-78.62	-44.02%	
	10	7%	10%	1,000	2,000	20%	25%	200	200	166	100	-66.01	-39.76%	
	25	7%	10%	1,000	2,000	20%	25%	200	200	149	100	-49.26	-33.00%	
Fixed interest	5	7%	4%	1,000	2,000	20%	25%	200	200	223	100	-122.97	-55.15%	
	10	7%	4%	1,000	2,000	20%	25%	200	200	241	100	-140.86	-58.48%	
	25	7%	4%	1,000	2,000	20%	25%	200	200	279	100	-178.97	-64.15%	
Fixed interest	5	10%	13%	1,000	2,000	20%	25%	200	200	179	100	-79.45	-44.27%	
	10	10%	13%	1,000	2,000	20%	25%	200	200	168	100	-68.33	-40.59%	
	25	10%	13%	1,000	2,000	20%	25%	200	200	157	100	-57.15	-36.37%	
Fixed interest	5	10%	7%	1,000	2,000	20%	25%	200	200	224	100	-123.94	-55.34%	
	10	10%	7%	1,000	2,000	20%	25%	200	200	241	100	-140.95	-58.50%	
	25	10%	7%	1,000	2,000	20%	25%	200	200	268	100	-167.99	-62.59%	
Deposits		7%	10%	1,000	2,000	20%	25%	200	200	200	100	-100.00	-50%	
Deposits		7%	4%	1,000	2,000	20%	25%	200	200	200	100	-100.00	-50%	
Deposits		10%	13%	1,000	2,000	20%	25%	200	200	200	100	-100.00	-50%	
Deposits		10%	7%	1,000	2,000	20%	25%	200	200	200	100	-100.00	-50%	

(3) after adjustment for indexation allowance

Table 7.2.36 Capital Gains Tax reserve for LAF fund

Table 7.2.36 Tax rate 35%			Solvency 0%		nil reduction in equity asset											
asset category	asset term	current yield	revised yield	not applicable												
				equity asset purchase price	equity asset market value	CGT rate for reserve	equity asset value change	current CGT reserve	current asset value	revised asset value	revised CGT reserve	amount of mismatch	required reserve			
		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)			
Equities																
Fixed interest	5	7%	10%	1,000	2,000	20%	0%	200	200	179	200	21.38	11.97%			
Fixed interest	10	7%	10%	1,000	2,000	20%	0%	200	200	166	200	33.99	20.47%			
Fixed interest	25	7%	10%	1,000	2,000	20%	0%	200	200	149	200	50.74	34.00%			
Fixed interest	5	7%	4%	1,000	2,000	20%	0%	200	200	223	200	-22.97	-10.30%			
Fixed interest	10	7%	4%	1,000	2,000	20%	0%	200	200	241	200	-40.86	-16.96%			
Fixed interest	25	7%	4%	1,000	2,000	20%	0%	200	200	279	200	-78.97	-28.31%			
Fixed interest	5	10%	13%	1,000	2,000	20%	0%	200	200	179	200	20.55	11.45%			
Fixed interest	10	10%	13%	1,000	2,000	20%	0%	200	200	168	200	31.67	18.81%			
Fixed interest	25	10%	13%	1,000	2,000	20%	0%	200	200	157	200	42.85	27.27%			
Fixed interest	5	10%	7%	1,000	2,000	20%	0%	200	200	224	200	-23.94	-10.69%			
Fixed interest	10	10%	7%	1,000	2,000	20%	0%	200	200	241	200	-40.95	-16.99%			
Fixed interest	25	10%	7%	1,000	2,000	20%	0%	200	200	268	200	-67.99	-25.37%			
Deposits		7%	10%	1,000	2,000	20%	0%	200	200	200	200	.00	0%			
Deposits		7%	4%	1,000	2,000	20%	0%	200	200	200	200	.00	0%			
Deposits		10%	13%	1,000	2,000	20%	0%	200	200	200	200	.00	0%			
Deposits		10%	7%	1,000	2,000	20%	0%	200	200	200	200	.00	0%			

(3) after adjustment for indexation allowance

APPENDIX 8

RESULTS OF THE STOCHASTIC INVESTIGATION DESCRIBED IN SECTION 5

Table 8.1. *Endowment Assurance Without Profits – Term 10 Years – Age 50 at entry – Duration 5 years*

Asset		Yield per cent		Reserves based on current conditions	Reserves based on revised conditions			
Category	Term (Years)	Current	Revised	Probability of ruin	Normal Reserves		Without yield limits	
					Percentage increase in assets	Probability of ruin		
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Equities		3	4	18.8%	28	5.3%	26	5.6%
Equities		6	8	19.5%	26	5.5%	24	6.7%
Fixed Interest	5	7	10	0.1%	11	0.0%	5	0.0%
Fixed Interest	5	10	13	0.0%	12	0.0%	1	0.0%
Fixed Interest	10	7	10	22.6%	19	0.0%	14	0.0%
Fixed Interest	10	10	13	0.0%	19	0.0%	8	0.0%
Fixed Interest	25	7	10	67.9%	33	0.1%	27	0.6%
Fixed Interest	25	10	13	0.1%	28	0.0%	16	0.0%
Cash		7	4	0.0%	14	0.0%	12	0.0%
Cash		10	7	0.0%	1	0.0%	0	0.0%

Table 8.2. *Endowment Assurance Without Profits – Term 25 years – Age 35 at entry – Duration 5 years*

Asset		Yield per cent		Reserves based on current conditions	Reserves based on revised conditions			
Category	Term (Years)	Current	Revised	Probability of ruin	Normal Reserves		Without yield limits	
					Percentage increase in assets	Probability of ruin		
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Equities		3	4	0.5%	8	0.4%	1	0.6%
Equities		6	8	1.9%	11	1.3%	5	1.5%
Fixed Interest	5	7	4	3.3%	63	0.0%	51	0.1%
Fixed Interest	5	10	13	2.4%	12	0.9%	*	*
Fixed Interest	10	7	4	3.5%	49	0.0%	39	0.2%
Fixed Interest	10	10	13	1.2%	19	0.1%	*	*
Fixed Interest	25	7	10	1.9%	28	0.0%	*	*
Fixed Interest	25	10	13	0.0%	28	0.0%	*	*
Cash		7	4	2.4%	83	0.0%	71	0.1%
Cash		10	7	3.4%	5	2.2%	1	2.9%

* The assets required would be less than those required in "current conditions" where the valuation is subject to limitations on the valuation rate of interest.

Table 8.3. *Endowment Assurance Without Profits – Term 25 Years – Age 35 at entry – Duration 15 years*

Asset Category	Yield per cent		Reserves based on current conditions		Reserves based on revised conditions		
	Term (Years)	Current	Revised	Probability of ruin	Normal Reserves Percentage increase in assets	Without yield limits Percentage increase in assets	Probability of ruin
(1)	(2)	(3)	(4)	(5)	(6)	(8)	(9)
Equities		3	4	12.2%	24	22	5.4%
Equities		6	8	11.6%	24	20	4.8%
Fixed Interest	5	7	10	4.0%	9	*	*
Fixed Interest	5	10	13	0.0%	12	*	*
Fixed Interest	10	7	10	3.3%	18	5	0.0%
Fixed Interest	10	10	13	0.0%	19	*	*
Fixed Interest	25	7	10	43.4%	31	17	0.0%
Fixed Interest	25	10	13	0.0%	28	1	0.0%
Cash		7	4	0.8%	20	18	0.0%
Cash		10	7	1.7%	3	1	1.0%

* The assets required would be less than those required in "current conditions" where the valuation is subject to limitations on the valuation rate of interest.

Table 8.4. *Whole Life Assurance Without Profits - Age 30 at entry - Duration 5 years*

Asset Category	Term (Years)	Yield per cent		Reserves based on current conditions	Reserves based on revised conditions			
		Current	Revised		Normal Reserves		Without yield limits	
					Percentage increase in assets	Probability of ruin		
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Equities		3	-	0.0%	#	#	*	*
Equities		6	4.8	0.5%	49	0.2%	24	0.3%
Fixed Interest	5	7	4	3.9%	201	0.0%	163	0.0%
Fixed Interest	5	10	13	3.7%	12	2.5%	*	*
Fixed Interest	10	7	4	3.9%	176	0.0%	142	0.0%
Fixed Interest	10	10	13	2.9%	19	1.9%	*	*
Fixed Interest	25	7	4	4.0%	136	0.1%	107	0.1%
Fixed Interest	25	10	13	1.6%	28	0.5%	*	*
Cash		7	4	3.2%	239	0.0%	197	0.0%
Cash		10	7	4.3%	11	3.2%	3	3.3%

The assets required would for both -25% and +25% changes would be less than those required in current conditions even with limitations on the valuation rate of interest.

* The assets required would be less than those required in "current conditions" where the valuation is subject to limitations on the valuation rate of interest.

Table 8.5. *Whole Life Assurance Without Profits – Age 30 at entry – Duration 10 years*

Asset	Yield per cent		Reserves based on current conditions	Reserves based on revised conditions				
	Term (Years)	Current		Revised	Normal Reserves		Without yield limits	
					Percentage increase in assets	Probability of ruin		
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Equities		3	4	0.2%	0	0.1%	*	*
Equities		6	4.8	0.6%	17	0.4%	4	0.6%
Fixed Interest	5	7	4	3.8%	96	0.1%	78	0.1%
Fixed Interest	5	10	13	3.6%	12	2.0%	12	*
Fixed Interest	10	7	4	4.8%	80	0.1%	64	0.1%
Fixed Interest	10	10	13	2.7%	19	0.7%	*	*
Fixed Interest	25	7	4	3.5%	54	0.0%	40	0.2%
Fixed Interest	25	10	13	0.8%	28	0.1%	*	*
Cash		7	4	3.1%	121	0.0%	101	0.0%
Cash		10	7	4.3%	9	2.9%	3	3.6%

* The assets required would be less than those required in "current conditions" where the valuation is subject to limitations on the valuation rate of interest.

Table 8.6. *Whole Life Assurance Without Profits - Age 30 at entry - Duration 25 years*

Asset		yield per cent		Reserves based on current conditions	Reserves based on revised conditions			
Category	Term (years)	Current	Revised	Probability of ruin	Normal Reserves		Without yield limits	
		(3)	(4)		Percentage increase in assets	Probability of ruin		
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Equities		3	4	3.4%	16	1.8%	11	2.3%
Equities		6	8	3.0%	15	1.4%	8	1.9%
Fixed Interest	5	7	4	5.6%	27	0.0%	21	0.2%
Fixed Interest	5	10	13	2.2%	12	0.1%	*	*
Fixed Interest	10	7	4	6.8%	16	0.2%	11	0.8%
Fixed Interest	10	10	13	0.4%	19	0.0%	*	*
Fixed Interest	25	7	10	1.8%	27	0.0%	2	0.7%
Fixed Interest	25	10	13	0.0%	28	0.0%	*	*
Cash		7	4	2.3%	43	0.0%	37	0.0%
Cash		10	7	4.5%	6	2.0%	2	3.4%

* The assets required would be less than those required in "current conditions" where the valuation is subject to limitations on the valuation rate of interest.

Table 8.8. *Whole Life Assurance Without Profits – Age 50 at entry – Duration 10 years*

Asset		Yield per cent		Reserves based on current conditions	Reserves based on revised conditions			
Category	Term (Years)	Current	Revised	Probability of ruin	Normal Reserves		Without yield limits	
		(3)	(4)		Percentage increase in assets	Probability of ruin		
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Equities		3	4	2.4%	16	1.3%	11	1.8%
Equities		6	8	1.9%	7	1.5%	2	2.0%
Fixed Interest	5	7	4	4.9%	34	0.1%	28	0.1%
Fixed Interest	5	10	13	3.1%	12	0.4%	*	*
Fixed Interest	10	7	4	6.0%	23	0.0%	18	0.2%
Fixed Interest	10	10	13	0.9%	19	0.0%	*	*
Fixed Interest	25	7	10	1.6%	24	0.0%	6	0.1%
Fixed Interest	25	10	13	0.0%	28	0.0%	*	*
Cash		7	4	2.5%	51	0.0%	44	0.0%
Cash		10	7	6.0%	9	2.3%	1	5.3%

* The assets required would be less than those required in "current conditions" where the valuation is subject to limitations on the valuation rate of interest.

Table 8.9. *Whole Life Assurance Without Profits - Age 50 at entry - Duration 25 years*

Asset		Yield per cent		Reserves based on current conditions	Reserves based on revised conditions			
Category	Term (Years)	Current	Revised	Probability of ruin	Normal Reserves		Without yield limits	
					Percentage increase in assets	Probability of ruin	Percentage increase in assets	Probability of ruin
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Equities		3	4	14.6%	26	3.5%	24	4.0%
Equities		6	8	12.9%	23	3.6%	19	4.4%
Fixed Interest	5	7	10	11.5%	9	0.0%	#	#
Fixed Interest	5	7	4	11.5%	#	#	2	4.2%
Fixed Interest	5	10	13	0.0%	12	0.0%	*	*
Fixed Interest	10	7	10	66.1%	17	0.0%	7	0.0%
Fixed Interest	10	10	13	0.0%	19	0.0%	*	*
Fixed Interest	25	7	10	84.2%	31	0.0%	19	2.3%
Fixed Interest	25	10	13	0.0%	28	0.0%	6	0.0%
Cash		7	4	0.7%	17	0.0%	15	0.0%
Cash		10	7	2.8%	3	0.6%	1	2.3%

Note that with limitations on valuation rates of interest it is the +3% change which is critical whereas without limitations it is the -3% values which apply.

* The assets required would be less than those required in "current conditions" where the valuation is subject to limitations on the valuation rate of interest.

Table 8.10. *Portfolio of Whole Life and Endowment Assurances Without Profits*

Asset		Yield per cent		Reserves based on current conditions	Reserves based on revised conditions		
Category	Term (Years)	Current	Revised	Probability of ruin	Normal Reserves		Without yield limits
					Percentage increase in assets	Probability of ruin	
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8) (9)
Equities		3	4	10.3%	24	3.2%	21 3.8%
Equities		6	8	10.1%	25	2.4%	21 3.2%
Fixed Interest	5	7	10	5.5%	10	0.1%	# 5.5%
Fixed Interest	5	7	4	5.5%	#	#	3 *
Fixed Interest	5	10	13	0.0%	12	0.0%	* 0.0%
Fixed Interest	10	7	10	13.3%	18	0.0%	7 *
Fixed Interest	10	10	13	0.0%	19	0.0%	* 0.0%
Fixed Interest	25	7	10	75.0%	32	0.0%	20 0.0%
Fixed Interest	25	10	13	0.0%	28	0.0%	6 0.0%
Cash		7	4	0.9%	19	0.0%	17 0.0%
Cash		10	7	1.7%	3	0.4%	1 1.1%

Note that with limitations on valuation rates of interest it is the +3% change which is critical whereas without limitations it is the -3% values which apply.

* The assets required would be less than those required in "current conditions" where the valuation is subject to limitations on the valuation rate of interest.

DISCUSSION

Mr C. P. Headdon, introducing the paper, said:—The paper to be discussed this evening is the second produced by the Valuation Regulations Working Party and is, in many ways, our swan song. In fact, since we were promptly disbanded after the Institute discussion last April, it could almost be regarded as a call from beyond the grave. However, the opportunity to rekindle discussion on this subject is one which we very much welcome.

The discussion at the Institute had an unusual feature in that two actuaries who had recently been senior members of the Government Actuary's Department (G.A.D.) spoke in a personal capacity. The views they put forward were quite radical, and in some respects went beyond anything we had suggested in the paper. Both were known at the time to have given up their responsibilities for life office supervision, and that no doubt made them feel able to speak relatively freely. Although they were, of course, speaking in a personal capacity, their remarks could be taken as indicating preparedness on the part of the authorities to be flexible and pragmatic in this area. In some respects, it is slightly disappointing that our paper has not yet provoked any further guidance or modification of approach from the G.A.D. However, in another sense, that is gratifying, since it indicates that decisions about any changes have not yet been finalised. Accordingly, tonight's discussion has the potential to make a further valuable contribution to the debate.

Looking beyond the bench-mark test itself, we get drawn into the wider debate about the whole regulatory regime, in particular the layering of margins upon margins inherent in the current system. A further working party has been formed to look at that broader issue, and I am sure any members of that group present here tonight will listen with interest to any contributions on that theme.

Our previous paper was discussed here a little under a year ago. That dealt almost entirely with linked business. As such, it had a somewhat limited appeal north of Watford. The current paper, however, deals primarily with non-linked business, and will, we are sure, be of very direct interest to those present tonight. We now look forward to hearing your views.

Mr R. P. Bews, opening the discussion, said:—The paper before us tonight may be the second produced by the working party but it is only the latest in a series of papers dealing with the statutory basis for valuing long term liabilities. I had the privilege of being associated with one of the earliest papers on this subject, which was presented in this hall in January 1975.

Regulations for the valuation of liabilities were to be published that year under the Insurance Companies Act 1974, and we were charged with considering how the celebrated 'six principles' could be translated into a regulatory valuation system. The paper's timing was impeccable, coming as it did just at the commencement of a twelve year equity bull market, though we were not to know that at the time.

At the present time, as the omens do not seem so favourable for the equity market over the coming year, this is a not inopportune moment for us to turn our attention once more to the valuation regulations in general and in particular to the resilience test associated with them. The resilience test is largely a rule of thumb which, in theory, should not require a great exercise of actuarial skill in its application. One might expect that any such rule must be firmly drawn if it is not to be capable of too wide a range of subjective interpretation. However, as the authors point out, certain ambiguities become apparent when the rule is operated in practice, and they draw attention to the more important of these. They carry forward from their previous paper a discussion of the concept of coherence, which strikes at the very heart of the test. The conditions postulated by the rule—that is, a sudden change in gilt yields and equity values to new levels which are then assumed to apply indefinitely—are, admittedly, unrealistic, though no more so than conventional deterministic valuation methods. If we are content to accept deterministic methods, then it seems to me the question of coherence does not arise. The regulations and the G.A.D.'s resilience test are based on such methods, and for the purpose of complying with the regulations, coherence can be ignored. It does not necessarily follow that the actuary can afford to ignore them in his internal investigation, but that is a matter which is outwith the regulations.

In paragraph 2.6, the authors suggest modifying the 25% rule to keep equity yields within a historic range. It is worth noting that for completeness they consider falls as well as rises in yields, whereas the G.A.D.'s resilience test looks only at rises. This leads them to apply similar principles to fixed interest yields. Both of these suggestions seem sensible to me, though deciding where to fix the limits must always be a matter of judgement. I would certainly not quarrel with the desirability of introducing more flexibility into the determination of limits as conditions begin to show signs of departing from the norm.

We turn now to paragraph 2.11. One problem mentioned here is the 7.2% limit on re-investment rate. At high interest rates and using the deterministic approach, it is difficult to see the justification for having such a limit. Common sense argues that if we allow for a maximum re-investment rate in valuing liabilities, we should also allow for it in valuing assets. However, the regulations make no provision for this, which in my view is a serious shortcoming. Clearly change would be desirable to make the valuation of liabilities and assets consistent in this respect. One way would be to allow for the limit in the valuation of both assets and liabilities. The authors indicate how this could be achieved for the latter, but make no compensating suggestion, for the former. I would prefer to see a more radical solution to the problem and would opt for removing the limit altogether. This would avoid the need to import into the regulations the V or W modifications of the net premium valuation formula. In view of the resistance which the statutory authorities have shown towards adopting these modifications, some of which were broached as long ago as in our 1975 paper, this would be no bad thing.

In paragraph 2.15 the authors suggest that a 1% change in the redemption yield for index-linked gilts would be broadly equivalent to a 3% change in fixed interest yields. This seems to be consistent with their suggestions for fixed interest when yields are low, but I wonder whether it might not be more appropriate to treat index-linked gilts in a similar manner to equities, to which they are arguably more closely related, and to make the change in the redemption yield 0.75%. For consistency, a similar change should be made in the interest rate for valuing index-linked annuities.

The methodology developed by the authors in Section 3 is a useful means of analysing how the need for a mismatching reserve arises. Section 4 takes the process a stage further by examining the important concept of the extent to which various categories of assets may be considered as suitable backing for specific classes of contract.

In paragraph 4.9 the authors consider the effect of the resilience test on the solvency margin. They say it is generally considered that provision for solvency margins in the changed conditions is not intended to be part of the working rule. In fact of course, the solvency margin does not come into the resilience test as such, since the purpose of the test is simply to ensure that the available assets are not overstated. The solvency margin is then deducted from the available assets and the result is what is known as the 'free' assets. Consideration as to what the solvency margin would be in the changed conditions does not seem to me to have much bearing on the case. Certainly an office's available assets would have to be at a very low ebb for the change in the amount of the solvency margin to acquire crucial significance, in which case alarm bells would already be ringing at G.A.D. and a second difference effect on the solvency margin would hardly be of prime consideration.

In paragraph 4.15 the authors revert to the question of the internal consistency of the valuation basis in changed conditions; in particular how this affects the basis used for valuing with profits policies. They point out the inconsistency inherent in the assumption, implicit in the test, that high yielding fixed interest securities would be held to back these contracts, and seem to conclude that in ensuring that the reserves comply with the statutory minimum basis, future bonus prospects need not necessarily be taken into account. On the way to this conclusion they put forward the alternative view—namely that the valuation basis in the changed conditions should allow for future bonus at the rate appropriate to these changed conditions—but they seem reluctant to pursue this matter to its logical conclusion. The argument really hinges on how far it is necessary to go in making allowance for the reasonable expectations of policyholders.

Policyholders' reasonable expectations are a bit like the unicorn — we all know what it looks like, but nobody has ever actually met one. We may each have our own idea of what constitutes reasonable expectations but I beg leave to doubt whether it would coincide with what an actual policyholder would expect, even in these days of LAUTRO controlled illustrations. The trouble with the concept of reasonable expectations is that it was conceived with the Platonic ideal of a policyholder in mind, not the policyholder you are likely to meet in daily life with all his warts and imperfections. For this reason, while I think the authors' definition is all very well in its way (as it happens, it agrees quite closely with my own) I would not like to see it tested before a learned judge, who would, in all probability, be a policyholder himself.

Having said that, how far should we allow for policyholders' reasonable expectations in applying the resilience test? I have little doubt that ideally it should be allowed for in accordance with the principles underlying the statutory regulations, namely by valuing with-profit business at a suitably lower interest rate than that used for non-profit business. However, I must admit that if I were to find myself in the position where to do so would require the setting up of a mismatching reserve, which could be avoided by valuing with-profits and without-profit business at the same rate, then I would probably opt for the latter course of

action. Of course there would be certain preconditions for this. I would have to satisfy myself that it was justifiable on the basis of the bonus reserve valuation carried out at a range of interest rates and allowing for future bonus supported at these rates. And I would argue that it would be proper to do so in view of the considerable margins contained in the statutory basis: in particular I have in mind the limitation on the re-investment rate.

Paragraph 4.19 deals with terminal bonus. I take the view that terminal bonus need not be reserved for, since there is not a guaranteed liability nor does it form part of policyholders reasonable expectations. An office may set up a reserve to cover the payment of terminal bonus for a limited period, if it wishes to reflect its determination to provide an element of stability in its bonus philosophy; but anything farther is, in my view, going beyond the bounds of what is strictly necessary, certainly as far as complying with the regulations is concerned.

However there seems to be an implication in what the authors say here that a terminal bonus reserve can sometimes be looked upon as a mismatching reserve under another name — in other words, it is simply another margin in the valuation basis. If this is indeed what they intend to imply then it strikes me as a potentially misleading practice, since it implies a degree of protection for terminal bonuses which policyholders may not in fact enjoy. In the event of a sudden sharp fall in equity values, an office which adopted this device might find itself obliged to cut terminal bonuses, which could give rise to questions as to the true nature of this reserve. The situation would be much clearer if the mismatching reserve was not hiding behind an alias.

Section 5 proceeds to examine how effective we can expect the working rule to be in practice. I sympathise with the authors' arguments for confining their attention to non-profit examples, though it must be a matter of opinion how far the omission of with-profit business affects the conclusions which may be drawn from this exercise. The authors may well be correct in claiming this is a more searching examination of the test since it eschews the ameliorating factors which the inclusion of with-profits would introduce but it would be reassuring to have a practical demonstration of this. What can be seen from the results of Table 8 is that in certain conditions, and for most practical purposes, the test tends to be fairly robust. Its effect is to reduce considerably the probability of ruin in most of the examples chosen, generally to a degree that I would regard as being more than adequate. It is a little surprising that the test is not more successful in drawing attention to the mismatch involved when equities are used to back guaranteed liabilities, but considering its imperfections it seems to work reasonably well.

All in all, I conclude the test seems to operate satisfactorily in conjunction with the statutory valuation basis, despite its mechanistic nature. It is not without its critics who argue that it imposes constraints on the rate at which an office can write new business and restricts investment freedom. Prudent managers of policyholders' funds are already aware of the demands which the writing of new business makes on their capital reserves, and realise that uncontrolled expansion cannot be maintained without eventually depleting these reserves. They also know that equities do not constitute a suitable backing for guaranteed liabilities, however attractive their long term prospects may appear when compared with fixed interest securities. To these managers conforming with the regulations does not present a problem, at any rate not in normal circumstances. Like the authors, I hesitate to define the point at which circumstances become abnormal, but I agree that they were certainly so at the end of 1974, which conveniently brings me back to where I came in. I thank the authors for a timely and stimulating paper, and trust that the relevant authorities will take due note of its contents.

R. W. M. Baxter: I should like to join with the opener in thanking the authors for a most interesting paper. My involvement has been with the practical application of the working rule, and I shall be restricting my comments to Sections 2 and 3 of the paper.

In paragraph 3.3 when dealing with the apportionment of assets to the different categories of liability, the authors state that where there are surplus assets the lowest yielding can be omitted. It is not clear to me that this is permitted by the regulations or by the guidance notes. Regulation 59(8) refers to the 'overall yield' and specifies the weight to be given to each investment in calculating such a yield. Regulation 59(9) permits apportionment but does not explicitly allow assets to be omitted from the apportionment.

Temporary Practice Note 2 states that free assets do not have to be brought into account in determining the matching position, but it is not clear how much can be read into this. I understand that originally the G.A.D. expressed the view that the mismatching reserve required to be large enough to cover any fall in the free assets incurred by applying the working rule. Given that the free assets could normally be considered

to be equities, the mismatching reserve would have to be augmented by 25% of the free assets. We now know that this is not the official view, and TPN 2 makes this clear. But is it not going further to imply that the valuation interest rates may be calculated omitting the low yielding free assets? If this is in fact permitted, it would be helpful if the guidance notes were specific on this point.

My second point refers to the suitability of the assets which are apportioned to the different liabilities. In paragraph 2.3 the authors say that the apportionment does not need to have regard to 'suitability' in terms of traditional matching. However Regulation 59(9) does include the words 'where appropriate' when permitting the apportionment. I am not clear what the difference is between 'suitable' and 'appropriate', and how a hypothecation of assets can simultaneously be 'unsuitable' as the authors would allow in paragraph 2.3 while still being 'appropriate' as required by 59(9).

Suppose for example, we have non-profit liabilities where there is a re-investment requirement, and therefore the 7.2% restriction applies. We assume that gilts are yielding 10% and equities 4%. It is tempting to allocate 63% of gilts and 37% of equities to these liabilities, as this would result in a valuation interest rate of precisely 7.2%. But would such an apportionment be 'appropriate'? The more stringent view is that 100% gilts should be allocated to non-profit liabilities, and this would give a valuation rate of 9.25%. The 7.2% restriction will thus cause the actuary to 'lose' over 2% of the available interest rate resulting in higher liabilities for the with-profit classes. The effect is greater when the 3% increase in yield is considered, when nearly 5% is lost by the 7.2% restriction. The authors clearly consider that this view is too stringent, but is the point of paragraph 2.3 generally accepted?

An extension of this problem occurs where we have with-profit cash contracts with non-profit annuity options. The authors touch on this in paragraph 2.11 without going into any detail. In a realistic valuation we might not consider these annuity options to be onerous, particularly if we expect there to be a significant terminal bonus element at the vesting date. However the options are significant when valued at the interest rates which we are permitted to use in the statutory valuation. To comply with Regulation 54, the actuary may consider it suitable to value such contracts at two interest rates; a low rate before vesting when the contract is with-profits, and a higher rate, for example 7.2%, when it is non-profit. But what assets does he need to hypothecate to allow this to be done? One view is that the assets need to contain sufficient gilts to produce the post-vesting valuation rate, and that the difference between the post and pre-vesting rates is lost. It may be that this view is too stringent, and that some alleviation of this is possible, and I should welcome other views on this.

Mr A. N. D. Shaw (for Mr R. Anderson): The words which make up Regulation 55 have never been a matter for contention by the profession. However protection of a life fund from the effect of fluctuations in the value of assets must primarily be arranged by having a suitable asset management policy, rather than by simply adjusting the liabilities. The necessity of adjusting the liabilities if a suitable investment policy is not pursued should be an effective constraint to ensure that a suitable policy is, in fact, followed, and that the nature and timing of the liabilities is reflected in the asset distribution.

In any period of equity boom, unless the distribution of investment is kept under constant review, the proportion of total assets held in the form of equities will tend to rise. Furthermore, when that part of the market appears to be producing almost immediate profitability, there is a temptation to place new money there, rather than in fixed interest stocks, thus making the situation potentially even more extreme. It was at a time like that that the Government Actuary issued his reminder to us in 1985. Dividend yields had been falling, on the whole, for the preceding five years, and we all know historically that when that situation persists too long, the market will react as it did eventually in 1987. The working rule introduced in 1985 was, in its own words, intended to suit the purpose of the time. One of the main purposes of the paper tonight appeared at first glance to be to examine its appropriateness to other economic conditions. Yet, I have failed to find more than the briefest mention of any proposal within it for adjustment of the working rule to suit the wide variety of conditions which have been experienced in practice.

One of the problems which the working party has had to consider is that the base line itself of a net premium valuation may appear reasonable in some economic conditions, but be entirely unreasonable in others. Actuaries who today have been willing to guarantee rates of interest of 4% for gross business, would not be willing to give that guarantee at all, if rates of interest fell to the all-time low of 2.5%. I wonder how many offices would be solvent today in those conditions, given the existing regulations and the necessity of restricting the net premium to the gross premium. That must be one area where actuaries are disregarding the possibility as too extreme, and I can only assume that the Government would then take a similar view

and not only propose a change in the working rule, but also some more material change in the regulations.

That is, of course, one end of the spectrum from which we are now remote, and I must agree wholeheartedly with the comment in paragraph 2.7 that "in a 5% interest climate, the effect of a -3% test would be far stronger a test that was ever intended".

However I am not at all in agreement that it would be reasonable in such extreme low-interest conditions to allow for a fall of one third of the then existing rate. No doubt if we ever get back to that situation there will be a lot of other changes in the meantime, but if the working party is correct in that supposition, then this should be affecting our valuations even today.

Present markets for short-term interest rates are, of course, close to the other extreme which the working party mentions in paragraph 2.7, namely 15%. Fortunately, there is no crisis of confidence at present so that long-term yields are much lower. As long-term rates rise, then cash flow becomes more and more important, and one dare not be found with too long-dated an asset mix. The limitation on the amount of the net premiums and the existence of interest guarantees are then of comparatively little importance but the limit of the assumed interest rate of 7.2% (mentioned in Section 7 of Regulation 59) begins to dominate. Again, one feels that the view taken by the working party that allowance for further rises in long-term interest rates need only be made at a much more restricted level is correct, but is only one side of the story.

It is certainly possible to hypothecate situations which are most unlikely to arise, and to which one therefore attaches a low probability of ruin, but which would cause problems for the vast majority of offices. Almost certainly, the event would be short lived, and of a technical nature only, unless of course the economy itself is in ruins. I certainly do not think we should bother too much about that possibility.

I return therefore to the original objective of Regulation 55. If the scenario to which the actuary points in postulating a valuation of the liabilities is such that it seems altogether unrealistic to those managing the funds, then that valuation in itself is unlikely to influence policy, and the actuary will be forced either to modify his view, or to present what may well be a ridiculously extreme viewpoint. There are thus limits to what is acceptable, given that in terms of the working rule an instantaneous change has to be assumed, with no changes in the asset mix. In what we regard as normal conditions, the working rule in its current form is tenable because the extremes which have to be considered are within the acceptable spectrum. However, other aspects of the net premium valuation seem less so, and appear only to be designed to give the regulators peace of mind.

Paragraph 4.17 of the paper, which attempts to reconcile a statement of what could be regarded as the reasonable expectation of policyholders, with the effects on bonus rates of varying investment conditions allowing for the mismatching rules, shows the illogicality of the process. The objective of overall management must be to ensure that the reasonable expectations of policyholders are fulfilled. But every change in conditions affects not only our perception of the past but also of the future, and there is no way that the reasonable expectations can be expressed in a rigid framework.

I note the remarks of the working party that they find it illogical that a higher mismatching reserve is required for equities backing a with-profit endowment assurance, than for equities backing a non-profit contract. The problem appears to arise from the declaration of reversionary bonus on the with-profit contract, and follows of course, perfectly logically from all the rest of the scenario but, most importantly, from the net premium valuation based on the dividend yield of the equity. Perhaps it was to this that the working party was alluding when they chose the quotation at the start of the paper. I can only hope that sooner or later either the regulations are brought into reasonable alignment with the type of business the industry is selling, or the industry itself succeeds in altering its products to be in sympathy with the regulations, without destroying its markets at the same time.

Lastly, on a minor point, might I mention that the tests have now to be further extended to take account of any Case VI tax liabilities which may arise in the course of the exercise. That in itself may add yet another dimension to the computations.

Mr J. S. R. Stocks: I find the paper very interesting and instructive both in the illustrations of the practical application of the working rule and also in the theoretical considerations.

The remarks in Section 2 on the treatment of other types of assets seem sensible, although consideration should be given to, for example, any new issues currently being underwritten by the office, to current and contingent liabilities (other than the C.G.T. liability which the paper has covered) and to borrowings, particularly overseas borrowing for currency hedging purposes. The modifications to the working rule suggested in paragraphs 2.6 and 2.7 also seem sensible from a historical perspective, but I would question,

in view of the increasing internationalisation of stock markets, with perhaps in future a greater volatility in equity yields, whether such modifications should be made. Further, it does not seem sensible to apply the 25% fall equally to blue chip equities and to say, speculative recovery stocks. I also wonder if consideration should be given to any correlation to movement in equity values and changes in fixed interest rates. Are movements in each strictly independent?

Section 3 demonstrates the use of matching rectangles. Assets are notionally allocated to each cell in the rectangle with, according to paragraph 2.3, no need to have regard to the suitability, in terms of traditional matching, of these assets to the cell liabilities. Assets can be allocated in such a way as to minimise any additional mismatching reserve, using as many trial calculations as thought necessary. For an office with many classes of business and a full spread of assets, determination of the minimum additional reserve could be a significant task.

The ultimate objective of the exercise is to determine the amount of the free assets in the life fund available to cover the solvency margin, with assets being considered as free only if they will not be required to support the liabilities in changed investment conditions, although the value of the free assets themselves will change. For offices with large investment reserves, or with a strong published reserve basis, there is no need to determine the minimum additional mismatched reserve unless it is felt necessary to maximise the excess of free assets over the solvency margin, for example, for 'best advice' purposes.

In paragraph 1.9 the authors state that the market fall in October 1987 should have removed any doubts as to the extent of the fall to be tested, and in paragraph 6.10 they suggest that the 1987 fall should not be considered exceptional. The end of 1974 is considered exceptional, and had current regulations been in force then, I presume that recourse could have been made to the margins in the minimum basis, or to the solvency margin. However, the 1987 fall did not give rise to any significant weakening of published valuation bases, nor to any general reduction in terminal bonuses. The marked rise before the October fall should not be ignored. Offices will tend to leave valuation bases unchanged, particularly for with-profit classes, with the investment reserve reflecting any movement in asset values. This is particularly so for proprietary offices where any weakening of the published valuation bases for with profits classes could affect the dividends paid to shareholders.

The problem, of course, lies with weaker offices, in particular in identifying at an early stage those offices which may be getting too close to the danger zone. Does the working rule work for such offices? In paragraph 6.4 and 6.5 the authors state that the results of Section 4 give a mixed picture, with reasonable consistency when the asset to liability match is intuitively sensible, but less so when it is not. This leads to the point which gives me the greatest concern. For an office near the danger zone it does not seem to me to be prudent to ignore the suitability in the traditional sense of the assets hypothecated to each class of liability. A minimum mismatching reserve based on an illogical hypothetical allocation is surely unsatisfactory, particularly if it could result in an unsound position appearing to be all right. If the G.A.D. uses the working rule as an early warning, is it not possible for the appointed actuary to do likewise?

This does not rule out hypothecating assets with a view to reducing any additional reserves; only that the suitability of the assets should be considered. I think most actuaries would approach the problem in this way. For example, hypothecating high-yielding fixed interest stocks to annuities in payments seems both logical and practical, avoiding at least partially the constraints of the 7.2% maximum re-investment rate. The same applies to hypothecating equities to with-profit classes, with low equity yields implying low valuation interest rates and hence an implicit, though not necessarily sufficient, allowance for future bonuses.

The question of allowing for future bonuses is considered in Section 4, from paragraph 4.15 onwards. As the authors state more than once, Regulation 54 must be complied with in the changed conditions of the working rule and this includes, by Guidance Note 8, having regard to the future interests of with-profit policyholders. This would preclude the test from being purely one of solvency as mentioned but not endorsed in paragraph 4.4. However it may be difficult to be precise about the effect of say, a 25% fall in equity values on the reasonable expectations of policyholders without considering what caused the fall. I have in mind here the section on yield and earnings effects in Appendix 2.

The purpose of the text is to ensure that the total statutory reserves are consistent with assets at market values, and in general I would agree with the authors' conclusion that the test is as satisfactory as any simple test is likely to be. I would recommend that not only the 7.5% of yield margin be included in the resilience test, but so should the 7.2% maximum re-investment rate. This will prevent layering margins on margins, and will avoid adding to the artificialities of the net premium valuation required by the regulations.

Mr D. J. Kirkpatrick: Most of my comments relate to the working rule and the suggestions made in Section 2 of the paper.

The paper comments on the use of two fixed points for this test and suggests in preference that the use of a profitability distribution may be an improvement. It does not, however, examine the question that if we are to do the test using two fixed points, are the points chosen the most meaningful ones? Certainly they appear to be far from being well established. Why is the consideration of a fall in the value of equity type investments at 25% deemed appropriate.

If we look at the UK equity market and calculate the rates of return achieved per quarter over the last twenty years, the average rate of return comes out at 4.3%. Rather worryingly, the mean deviation from this figure is as high as 27 percentage points. The standard deviation is 13.4 percentage points. At roughly twice the standard deviation perhaps the 25% figure appears reasonable. If we assume something close to a normal distribution then the probability of exceeding such movement is fairly small. It does, of course, exist, as was illustrated in October 1987.

The question I really want to address is that if an assumed 25% fall in the UK equity market is deemed to be a reasonable test, then what should be used for overseas markets, and in particular for a portfolio of equities with a high overseas content. I was disappointed having read paragraphs 2.13 to 2.19, where the paper deals with the treatment of other types of assets, that the authors stopped short in paragraph 2.20 of dealing adequately with this question nor do they deal with the vexed problem of currency exposure. Mr Grace and I touched on this subject in a paper to last year's international congress. Since then colleagues and myself have done considerable further work looking at the volatility of different equity markets and the volatility of different equity portfolios. Looking at rates of return over the same period of the last twenty years the volatility of the different equity markets does vary of course, but what is more interesting is to look at what happens to this volatility as portfolios become more evenly balanced between the different markets.

I mentioned that the standard deviation of the rate of return for the UK equity market has been 13.4 percentage points. If we use a portfolio constructed in proportion to the FT Actuaries' World Index then this standard deviation falls to 8.8 percentage points — quite a difference. Surely, we have a much more resilient portfolio. However, as that portfolio would hold only 9% in UK equities this may be felt to be rather an extreme position. I shall return to the interesting question of why it should be felt to be extreme.

If this portfolio is unacceptable, what happens if we use a portfolio with 30% in the UK, 20% in America, 25% in Japan, 10% in the other Far Eastern markets, and 15% in Europe. The standard deviation has been 9.1%, which is fairly similar. Varying these proportions does not affect the result significantly as long as there is a reasonable spread. What this appears to illustrate is that such equity portfolios are considerably more resilient than one which is concentrated in the UK equity market. This should hardly be a surprising result. We all believe in the benefits of balance and spread within an equity portfolio. Unfortunately, the logic of that position seems to stop short at national boundaries. Fund managers everywhere have their portfolios highly concentrated within their domestic market. What, if any, is the real logic that is behind this? It almost appears that there is a general belief in all countries that all overseas markets are inherently risky.

As a profession we hide behind statements like "assets should be predominately invested in the same currency as the liabilities." I can understand this for fixed interest investment where a cash flow matching position can be achieved, but no one has ever explained why it should be appropriate for equity investment. Does it increase the certainty of a good return to have all the assets invested in a single market? Being invested in a single market is the high risk position, in much the same way that being invested in a single stock is a high risk position. The fact that it may be the domestic market does not reduce this risk.

It should be pointed out that the figures I have given do reflect the returns in sterling terms and that they do include the effective currency movements. As it happens, using local returns, the results are very similar. I had rather expected that by adding further variables, including the effect of currency movements, that the standard deviations would fall. In fact they do not. I suspect this is because the movement of each currency is positively correlated with the movement in the appropriate market. What conclusion then can be drawn from this?

It seems clear that using overseas markets in fact reduces the risk of insolvency. The resilience test should be less stringent for a balanced global portfolio than for a purely UK portfolio. From a comparison of the relative volatilities, if a 25% fall is an appropriate test for the latter, then something like an assumed 15% fall would be suitable for the former. There should of course be no currency mismatching reserve required. These comments have particular reference to Regulation 25, which limits the extent to which a firm can be exposed to overseas currencies. On what logic is this regulation based? How are we protecting our

policyholders by being forced to concentrate our equity investments in a single market? The result of this Regulation is that equity portfolios are far more volatile, and therefore less resilient than they could otherwise be. It seems to me that it is long overdue that this subject be looked at much more closely, both by appointed actuaries and by the authorities. It may be interesting to note that the better balanced portfolios that I suggested earlier not only have more resilience than a UK portfolio, but they have also in the past provided a significantly higher average rate of return.

The cost to all our policyholders of this irrational fear of overseas markets and overseas currencies has been considerable.

Mr S. F. Elliott (FIA): I will make only a few comments on this paper which has a vast wealth of detail. Firstly there is the interpretation of possible modification of the guidelines, and I agree with the opener and other earlier speakers, that we need to be flexible on this. It seems very sensible to make some amendments when extreme conditions arise, whichever way markets move, and there are of course some suggestions in paragraph 2.6 of tonight's paper. As a rough guide, my tentative feeling is that if the dividend yield were greater than 6% in a time of moderate inflation, then testing for a 12½% fall in equities would be a little harsh. On the other hand if the yield were less than 3.4% we should certainly test for a fall of greater than 25%. Referring to some earlier speakers, in particular the one immediately preceding, it also depends very much on the nature of one's portfolio.

I generally support the Working Party in their comments in paragraph 2.17 and feel there should be no difference in treatment between equities and properties. As mentioned earlier what we cannot ignore is the extra volatility caused by investment in overseas markets, and therefore I also agree with the comments in paragraph 2.18. To what extent should the Actuary allow for a modest level of switching into more volatile assets, and in particular what should he do for linked business? I think to allow for wholesale switching into the most volatile specialist fund available would be going a little too far, but it could be very difficult to decide just what is reasonable and what provision should be made.

Next there is hypothecation of assets. Here I would agree with Mr Baxter. Despite the wonderfully intricate and clever calculations that could be done, I much prefer straightforward hypothecation. Also, I think a logical hypothecation helps to make the process more coherent. I am glad that the Working Party included the solvency margin. While I agree that it does not appear to be necessary, indeed it may not be important except in extreme conditions, I think it helps with coherence.

Lastly, there is the net premium method itself. When is the net premium valuation not a net premium valuation? Is it when one uses W2 or W3? What precisely is the minimum statutory valuation basis for the UK?

Perhaps the only answer to the latter question is that basis which is acceptable to G.A.D. These modified formulae have languished in a sort of alpha-numerical netherworld for too long, and we need to know whether they are acceptable. I think they should be. Appendix 7 shows the effect of using W3 before and after the changed conditions. The results are interesting, but I think it would be useful to examine the ratio of W3 reserved after the change in conditions to the unmodified net premium reserves before the change.

So, with all the scope for technical invention and imaginative hypothecation, what is the Actuary to do in practice? It is clear that this must depend on circumstances. In normal conditions, the Actuary of a well established with-profit office should only need to apply the standard resilience test in a relatively straightforward way to demonstrate the adequacy of his basis. However, he will probably also test the more extreme changes with valuation margins progressively stripped out. Presumably, if there had been a severe adverse change immediately prior to a valuation, so that the regulations were, in his view, unreasonably stringent, then he would wish to exploit such methods as were open to him. The Actuary is not playing a sort of Regulation 55 game, where he always exercises whatever trickery he can think of, whilst remaining within the regulations. Regulation 54 is still paramount — therefore the advent of such regulations and the G.A.D. guidelines to Regulation 55 have in no way diminished the judgement required by the Actuary.

Mr D. G. Robinson: Although the authorship of this paper is attributed to this large number of authors, there are a number of unsung heroes who played a vital role in the preparation of this paper. As a member of the Working Party I would like to place on record my personal gratitude to two colleagues from my own office, namely Alan Kennedy and David Fraser, who put in a tremendous amount of work on the paper, and without whom Appendix 7 would have never been produced in time.

I am struck by how far actuarial thinking has come in the last four years or so, and the extent to which

attitudes to mismatching reserves have changed. I was one of those fortunate enough to attend the Birmingham Actuarial Convention in September 1985, and on the afternoon of the 12th, I attended a session on surrender values and policy alterations, so missing the session on valuation regulations, at which Mr Cannon released what, at the time, was regarded as something of a bombshell; namely the working rule. Speaking to those who had attended the valuation session, many were somewhat indignant at what Mr Cannon had said and felt the initiative had to be opposed. I have no reason to believe that the views I heard expressed were unrepresentative and I think that this desire to put a stop to these "silly rules" was probably the catalyst for the revival of JRWP and for the birth of VRWP.

Four years later, although the working rule is open to some criticism on grounds of insensitivity to the state of financial markets at the date of the valuation, it has been generally accepted as reasonable by the profession. No doubt, the crash of October 1987 and the recent 'crash that never was' have helped to concentrate all our minds. Sudden falls of 25% or more in equity values are nowhere near as far-fetched as some of us once thought they once were.

Reasonable expectations were the subject of vigorous discussion within the group, and the two opposing positions are set out in paragraphs 4.17 and 4.18. The basic question is, whether when conducting mismatching tests, appointed actuaries should take account of reasonable bonus expectations under the new investment scenarios. In other words, do appointed actuaries need to be able to demonstrate solvency, assuming the payment of a level of bonuses appropriate to the new financial conditions, or can they assume lower bonuses or no bonuses at all? I would be very interested to hear the profession's views on this.

Concerning the opener's comments on reserves for terminal bonuses, while I accept that they might lead to unrealistic expectations from policyholders, in my opinion the omission of such reserves is equally unsatisfactory, leading to an unrealistic and misleading picture of the office's financial position for example in terms of its free asset ratio. Terminal bonus reserves are for terminal bonus at the current level; they are not necessarily reserves for the terminal bonuses that would be paid if market levels were to change. I assert that appointed actuaries would not be holding adequate reserves if they did not hold specific reserves for terminal bonuses. It is largely a question of what you call these reserves. By calling them mismatching reserves perhaps is slightly misleading as the opener suggested, but I believe that reserves for this purpose are nevertheless required.

Mr H. J. A. Scott: I first took an interest in Life Office Statutory Returns when, as an actuarial student in my office's Valuation Department, I helped prepare a set of Returns in 1977. I maintained my interest at least until 1978 when I produced a brief note on the subject for the Glasgow Actuarial Student's Society. I remember that in that paper I drew attention to two questions that I thought were commonly given inadequate answers. One of these was the question asking for "specific reference to . . . the extent to which account has been taken of the nature and term of the assets available . . ." and the other was the question on "the general principles on which the distribution of profits . . . is made . . .".

This paper deals with one of these questions, and if we are primarily concerned with solvency, the mismatching question is the more important of the two. However, if we are to take up the question of "reasonable expectations" that is raised in the paper, then I suspect that for many offices and policyholders, a question about the principles underlying the bonus distribution policy would be an important one, although it may be that the question needs to be re-worded if we are to expect helpful answers. Reasonable expectations is a subject we must return to on another occasion.

In their introductory paragraph 1.11, the authors refer to two types of mismatching: big bang mismatching and cash flow mismatching. The report only discusses one of these and the obvious question arises as to whether big bang mismatching is really the right one to concentrate on. I cannot give an authoritative answer to this question but on looking through the Tables 8.1 to 8.10 it does appear that the examples that show a high probability of ruin are, very often, the cases that exhibit a classic mismatch in the cash flow sense. For example, in Table 8.1 the high ruin probabilities are where the 5-year liability is matched by assets with a 10-year, a 25-year or an indeterminate redemption date. Can the authors tell us how confident they are that in this paper they have been directed to the right question?

In paragraph 2.5, the authors define what they mean by insolvency. "Insolvency" they say, "means an inability to set up the statutory minimum valuation reserves under the 1981 Regulations". This is not what many of us, or our accountancy colleagues, would mean by insolvency. I am taking the sentence out of context, but I think it is useful to remind ourselves that in dealing with what started as an internal working rule in a Government Department, we should not be too concerned about equity between offices or about

its precision. We are not dealing with a new rigid standard to which we must all comply. We are simply accepting that the working rule represents a point where the supervisory authority can reasonably come and ask for some results based on more detailed investigative work.

Finally, I am always interested in the question of reserving for discretionary benefits, such as bonuses which have not yet vested, and the authors raise this subject in paragraph 4.16 and 4.17. I have always thought that one of the primary justifications for the net premium method of valuation was that, by using the net premium, we explicitly exclude the bonus loading from the premium to be valued. This effectively reserves the future bonus loadings to contribute to future bonuses. This may not work out exactly, because the premium basis will not be the same as the valuation basis, but the principle still applies. Do the authors wish to suggest that the reasonable policyholders expects more than this and that we must reserve more than this?

Mr J. L. McKenzie: The paper discusses at some length the working rule, but at the end of the day, in my opinion, we are left with what is a purely mechanistic process which places a great weight on quantity, but not an awful lot on quality. I can appreciate the authorities' desire for a simple working test and it may well satisfy that criterion as it applies to all offices equally. However, as the authors point out, this approach can mean that mismatching reserves will be created when not really necessary, but equally which may not be adequate, in the traditional sense, since the final figure brought out will be subject to Regulation 54.

I was struck by the seeming futility of the process of matching rectangles in that, having taken margins on margins, and having tested the resilience of valuation reserves, perhaps by some repeated allocation of assets to minimise the mismatched group position, the Actuary would be left with a figure which had statutory relevance but little more.

In paragraphs 4.15-4.18, the working party confirm the view that the test is intrinsically limited in scope, since the Actuary would apparently place values on certain contract types which would not be satisfactory to him otherwise. Within the context of the test as currently constituted, I would agree with authors comments in 4.18 that the impact of the test is purely a means of setting safety limits on solvency (at least in the statutory meaning of solvency).

As the authors suggest, the full topic will need to be revisited after the working party dealing with reasonable expectations has reported, and to me this takes the argument full circle: that the Actuary must use his professional judgement in setting the reserving levels. Therefore, should he not then have a similar freedom in establishing the mismatching reserves?

Notwithstanding the desirability or otherwise of having such a test, I think the authors' suggestion in paragraphs 2.6 and 2.7 is a desirable change. G.A.D. has indicated that the test was to be applicable at the time that it was set, and that it would be altered quickly if necessary (since it is a working rule and not a Statutory Regulation). In the rule, using the adjustment as suggested, however, I would ask the Working Party what base they would have for the prevailing equity yield variation they suggest? Would they use the yield on an index such as the all-share index, the Form 45 yield for equities which each office would declare, or the yield on the equities actually brought into the test. This would be of some relevance to those present tonight since at December 1988, the FT all-share index yielded 4.7%, but many of the offices subsequently disclosed Form 45 yields of between 3% and 3.7%. There seemed to be some ambiguity as to what the actual rates and the adjustment would be.

The authors also highlight the difficulties which arise by simply applying the Regulations, and it is slightly surprising that these were set in such a way, in particular the 7.2% interest cap, when there is no standard actuarial technique which satisfactorily handles it. The authors suggest that work is ongoing to resolve this, although, of course, the regulators could solve that problem for us themselves.

Finally, the authors point out in paragraph 2.18 that options and other similar investments are treated at wasting assets, and for the purpose of this test, are probably consigned to the assets not actually forming part of the test. However, if these options are used as hedging contracts, then in the changed conditions of, for example, -25%, it would seem that the options do in fact have some value; I therefore ask the question to what extent should the financial protection of options be allowed for the actuarial mismatch test?

Mr P. J. Pook: When he opened the discussion of this paper at the Institute, Mr S. F. Elliott raised the question of the reserves acceptable to the authorities, and to the professional conscience of the actuary. I quote: "Whatever minimum reserves are acceptable to the authorities, however, they must be acceptable to the professional conscience of the actuary. It would be nice to think there would be little difference between these two figures. In practice there may well be." However, we must also ask ourselves which authority we

are talking about, and which way their thinking runs.

If we mean the DTI, as advised by the G.A.D., then we are indeed talking about the minimum reserves which they consider to be adequate. On the other hand, an authority we have to consider is the Inland Revenue, who seem to be more concerned with the *maximum* acceptable reserves. In particular, they are suspicious of “additional reserves” for general contingencies, although these may well have to be taken into account for resilience or mismatching purposes. Thus the actuary may find himself or herself having to prepare, at the same time, two sets of arguments:

- one to satisfy the DTI that the reserves held are large enough
- the other one, to satisfy the Inland Revenue that they are not too large

I understand that this latter point is likely to become more significant following the 1989 Finance Act, as a previous speaker has already mentioned.

This leads to a view that mismatching reserve calculations should perhaps be carried out separately for each statutory long term fund and taxation class, with no off-setting of pluses and minuses between these categories, in order to justify their reserving requirements for taxation as well as for internal purposes.

Finally, I would like to mention a view which questions the Working Party’s suggestion for the treatment of index-linked gilts in the application of the working rule. This view which I have encountered in my own office, is that because index-linked gilts are defined as being something other than fixed interest they might be more like equities, so the corresponding assumption should be derived from the –25% test, rather than the + or –3% test. I am not entirely convinced of which way this view should go; and I would be interested to hear what others think.

Mr J. F. Hylands: After reading this evening’s paper, I was prompted to look back at the discussion which took place in this hall almost exactly seven years ago on an “Exposure Draft of Additional Guidance Notes for Appointed Actuaries”. In the course of that discussion, Professor David Wilkie commented on one particular sentence in the “Exposure Draft” — he said “I haven’t the faintest idea what that sentence means in the context”. The sentence to which Wilkie referred came in a paragraph which dealt with the application of Regulation 55, and in particular, the range of possible future changes in the value of the assets which had to be allowed for in calculating mismatching reserves. The sentence read — “No arbitrary method based on rule-of-thumb approximation can be a satisfactory alternative to the exercise of professional judgement.” That sentence, perhaps fortunately, was deleted before the draft became part of our professional guidance as GN8.

Wilkie’s point was that when considering appropriate provisions to be made against the effects of changes in the values of the assets, actuaries at the time had no satisfactory corpus of knowledge on which they could base their professional judgement. Wilkie went on to urge the profession to carry out research, with a view to establishing a satisfactory investment model, and two years later, he provided “A Stochastic Investment Model for Actuarial Use”.

The authors of this evening’s paper have made extensive use of Wilkie’s model to test the reasonableness of the working rule approach. The results which they summarise in Section 5 of the paper show that the working rule test is reasonably consistent where the asset-liability match is one which is intuitively sensible. They point out however, that the test is less satisfactory where the asset-liability match is less usual, for example, where non-profit liabilities are matched by equities. I would join Mr Baxter and other speakers here in questioning the validity of the approach described in paragraph 2.3, where it is suggested that one can disregard the suitability of the assets to match the liabilities against which they are hypothecated in applying the working rule test.

The authors point out in paragraph 5.3 that the reliability of the answers brought out by using a model can be only as good as the assumptions underlying that model. They believe, however, that Wilkie’s model is suitable for their purpose. While it is certainly true that Professor Wilkie’s model has been welcomed by actuaries as a valuable tool, I think it would be fair to say that its acceptance by the profession has been less than total. In particular, doubts have been expressed about the validity of the tails of the distributions, and consequently about the ability of the model to identify correctly the probability that major bear markets, which have occurred only twice this century will occur again, and that their effects will persist. At the 1% probability level, the model used by the authors predicts a sustained downward movement in equity values. It is hardly surprising then that the probabilities of ruin shown in Appendix 8 are so high when investment in equities has been assumed.

To return to that sentence to which Wilkie took exception, “No arbitrary method can be a satisfactory

alternative to the exercise of professional judgement". In the final sentence of their paper, the authors remind us that the actuary's own judgement is of paramount importance. That is indeed so, but the scope for the exercise of that judgement may be somewhat limited when he has performed a net premium valuation based on running yields with a 7.5% margin, with a further 7.2% limit on the yield on future investments, and then has set up an additional mismatching reserve based on the working rule test.

Mr Bews and Mr Stocks have both suggested, and I would agree with them, that both the 7.5% and the 7.2% limits should be subsumed into the resilience test. Mr Headon in his introduction referred to the effects that can arise when margins are laid upon margins. For an office writing with profits business backed substantially by equities, the reserves demanded by the present statutory valuation basis can be very onerous indeed. They may, however, be significantly reduced if the office is prepared to invest to a greater extent in fixed interest securities. As the authors point out, the application of resilience tests to with profits business rests crucially on interpretation of "reasonable expectations". The success of with profits business has been based to a considerable extent on the good returns paid to with profits policyholders, which in turn have resulted from offices having been able in the past to invest heavily in equities. There is no doubt that in its application to with profits business, the present statutory valuation basis acts as a disincentive to equity investment, and in consequence threatens the levels of returns paid to with profits policy-holders.

Past generations of with-profits policyholders have enjoyed returns which reflected the performance of the equity investments backing their policies. The profession must ensure that in seeking to refine the resilience test, it does not further inhibit offices from satisfying the reasonable expectations of their with-profits policyholders, that they will continue to enjoy returns based substantially on equity performance.

Mr D. M. Pike: *I would like to make two brief comments.*

Firstly, to take up the point that Mr Scott was making. I think it is necessary for the actuary to test for both big bang mismatching and for cash flow mismatching. The method described in Section 3 and in Appendix 5 is, of course, only really suitable for big bang mismatching, and a quite different technique is needed for cash flow mismatching.

Secondly, I think it's unfortunate that the Working Party restricted themselves to non-linked business in the current paper, having treated linked business in their earlier paper. I have, on occasions, found it essential to include linked business and non-linked business together in the mismatching analysis, and the method described here proved invaluable. In one particular situation I have seen, the negative sterling reserves were effectively matching non-linked liabilities, and some unexpected things can happen when testing big bang scenarios in this sort of situation.

Mr W. B. McBride: The first point I wish to make is to add my support to those who are making pleas for flexibility and pragmatism on the part of the authorities. I have not seen any visible signs yet, and I do not think it is only from the Revenue that we want this movement to come.

The second thing I want to do is offer some reflections on Section 6.10. The authors say "commonsense tells us . . . it is quite inappropriate to impute any sort of iteration into a resilience test". To forbid any sort of iteration seems extreme. There may be something quite convenient, I suspect, about the way in which stock market falls or quasi falls tend to take place in October, and not in January; this certainly saves us having inflated balance sheets and very large and very vulnerable investment reserves showing through. I do think some kind of imputation is implied when markets move, or when it appears they are going to move, some kind of precaution could be taken on that score.

I would draw the meeting's attention to Appendix 3, just to look at the graph of yield curves there. The yield in equities does not now look historically outrageous, nor did it do so in 1987. If you look at the years 1967-73, and the years 1981-87, and the shape of the thing, the little hook at the end of 1987 is very appropriate and was very useful to us all, for what would the position have been if it had not materialised. Of course, behind this, interest rates from that earlier period had risen quite sharply, whereas at the end of 1987, they had, if anything, fallen. And now we've had this mini hiccup this October, and we do not know what to expect next. Any actuary who at the end of 1987 had thought he ought to be more than normally prudent, perhaps as prudent as a government actuary, if not more so, and had taken certain steps, and suggested to his office that a large part of the equity holdings be moved into gilts would cut into reasonable expectations at once. Mr Bews presented to us a picture of a policyholder, warts and all, and certainly such a person is a fearsome animal when roused to demand his reasonable expectations, he has a different idea of what those are when he is so roused than the authors would suggest in Section 4.17.

This doesn't lead me to any very substantially mathematical conclusion, but merely to say that more resilience in the resilience test is something I would certainly support.

Mr C. M. E. Jones: I started reading this paper in the normal way going to the conclusion first and working backwards and I found that I was most encouraged that I could agree with the conclusion set out in the very last paragraph. The working rule is set out in Section 8 of the G.A.D.'s memo is only one tool among many available to the Actuary and this should not become the overriding rule to which everything else should be secondary. There is however some danger then when a working rule like this is put forward it insidiously finds its way into the regulations and this must be very much resisted. There appears to be some indications that the Irish Authorities are going to set up some regulation which includes the working rule. I would entirely agree with the point in paragraph 2.5 that there are circumstances where the plus 25% can be important and I think that any investigation to be done should be using the plus and minus 3 or plus and minus 25. The variations that were set out in paragraph 2.6 and the following sections all seem reasonable and do not appear to be out of line with the G.A.D.'s memorandum provided that the working rule can be taken to reflect current investment conditions. For example, if the rate of interest rose from 4 to 5% I would hope that the working rule would change from the plus or minus 3%. In all the calculations we are faced with the two constraints — the 7½% deduction from yield and the 7.2% limit on reinvestment. These have been mentioned several times this evening. I do not see that any of these serve any useful purpose if adequate reserves have been set up. The 7.2% rate seems particularly irrelevant if interest rates were to rise substantially. If we have to assume the 7.2% I would make a plea that we should be allowed to value the assets on the same type of basis taking a cash flow of the income expected from the assets and discounting this. As far as currency mismatching is concerned I would agree that there is a need to look further into this as more and more offices are investing heavily overseas and it is becoming more important. I was disappointed that the paper did not expand on this. I am not so concerned about overseas business where presumably the assets and liabilities are matched. However it may be possible that in the overseas markets that we are concerned with the + or - 25% or + or - 3 are not relevant factors, and these applicable to the country concerned should be used.

I am concerned with the question of hypothecation where it seems to be that you can hypothecate at various stages throughout the exercise and carry on hypothecating until you get the right answer. I would much rather go along with the previous speakers and try to get a model of the office which represents a reasonable allocation of all the investments, and use this as the basis for the plus or minus of the working rule. I did some quick calculations on a simple portfolio, not dissimilar to the one set out in the Appendix 5, and got some very interesting results. I could produce more or less any mismatching reserve that was required by making the required set of assumptions: the figures range from about 100% to 140%. Some of these bases were obviously completely irrelevant, but there is the danger that we, the actuaries, given this tool in this form, will seek always to find the lowest answers, regardless of whether it is the best answer.

I was disappointed that there was no more consideration of with-profit policies, especially in the later appendices, because to many of the offices concerned here in Scotland, with profits business is very important. I know that there are the margins hidden away and therefore the mismatching is perhaps not so important, but I would have liked to have seen some mention of this.

The one point that seems to come out of it to me is that I am not convinced that the net premium valuation, even modified, produces the right sort of answer for the statutory bodies. It's a nice easy method — they can see answers, but I'm not sure that it gives the true picture of the strength of the office. What I would like to see is some sort of standardised bonus reserve method to be used, with each office producing their own valuations rather than trying to do a net premium valuation, and leaving it to the actuary to decide what mismatching reserve is required.

Mr A. D. Shedden: I was rather surprised to see the prominence given in the paper to alternative net premium systems (W1 and W2 etc), and I could not see the point of Appendix 7 which uses a method which, as far as I know is not permitted under the Regulations. Is this method, in fact, permitted "under the counter" by the Government, or is the Working Party suggesting that we should move to such a method of net premium valuation? The Working Party have said that with the mismatching test the 7.2% interest limit is unnecessary, and also that the 3% interest margin requirement should be subsumed into the mismatching test. I would not dispute either of these contentions, and indeed it had been my impression that the G.A.D. were sympathetic at least to the removal of the 7.5% interest margin. Having got to this stage, however, I

would suggest that it is time we consider jettisoning the net premium valuation altogether, rather than have some similar artificial modifications as outlined in the paper. Why was there a net premium requirement in the first place? Was it to satisfy European doubts as to the stringency of our valuation regulations, as was at one time hinted? Was it to avoid the capitalisation of future profits and losses, the traditional actuarial fear? Or was it to introduce some form of implicit bonus provision, a feature that has been emphasised on several occasions by the G.A.D.? However, surely in the context of cash flow and ruin calculations, and even in the context of a simple resilience test such as has been devised with the G.A.D., the net premium requirement now is not only out of place, but disturbs the whole balance of the regulations; its existence makes it difficult if not impossible to construct coherent regulations and practices that would cover the valuing of both single premium and annual premium with profits contracts, and would provide systematically and appropriately for contingency margins, including of course provision for future bonus on the with-profit contracts.

It is time the regulations were redrafted from the very beginning, on a basis which takes account of modern developments, and, horror of horrors, takes account also of the actual future office premiums receivable.

President: At this time we are striving to convince our much more regulated friends in Europe of our actuarial rectitude. The investment portfolio of our life companies is totally unknown to most of them, and if they know they do not actually believe it. We have a wish to retain this kind of investment freedom, and, whatever we may think of the details of such resilience testing, without it our argument would be very much weaker. It might be interesting if we can provide a summary of this paper and of the discussion (considerably edited) for the benefit of the lobby which is now going on, because I think it will add strength. But our discussion is not entirely finished; Paul Grace will close it.

Mr P. H. Grace: Early in their paper, the Working Party make reference to the first public announcement on the working rule by a member of the G.A.D. Like some of us present, I remember the occasion particularly well, but more so than others who have spoken before me, because I had been volunteered by a member of the G.A.D. to chair one of the two valuation sessions at which one of their number was making a presentation, and I had responded to him by saying "You must want me to learn something": at the time, I didn't realise I was making a prophecy.

There was some evidence from the returns made by offices at the end of 1985 that the working rule had not been fully understood, but these misunderstandings were quickly resolved, possibly by the authorities. Although as stated in the paper the working rule is generally accepted, I welcome the authors' analysis of the rule and its applications. In particular, I like the results of Section 4 summarised in Appendix 7. In this connection, I appreciate my attention being drawn to Mr Fine's work on a net premium approach using two rates of interest. This type of exercise could prove useful in considering the best way of hypothecating assets amongst the various classes of business.

As stated in the paper, under the hypothecation exercise for mismatching tests, assets do not necessarily have to be suitable for the class to which they have been hypothecated, and perhaps mismatching reserves could with careful hypothecation be reduced. But on the question of hypothecation, both Mr Baxter and Mr Hylands queried some of these statements, in particular those to the effect that low yielding assets can be disregarded. Mr Baxter expressed the view that this conflicted with the regulations, in particular Regulation 55; but as he pointed out, hypothecation is permissible under one of the later regulations. Unless we can adjust the yields to reflect such hypothecation, we must surely question why the regulations allow such procedures. It must be remembered that at the end of the day the objective of the regulations is to test the solvency, and free assets are in excess to those requirements.

With reference to the working rule, the paper drew attention to the fact that care must be exercised, in particular in the -3% test, to restrict the yield in equities to the revised yield; that is, the -3% figure in respect of consols. Care must also be taken in considering the reinvestment rate, as under Regulation 59(8), the valuation rate must not exceed the weighted average market yield.

The working rule can be criticised on several counts, and the authors' draw attention to two. That firstly it is a test for only two situations, and secondly that the rule is relatively inflexible; a point on which both Mr Bews and Mr Elliot commented. Could perhaps more work be done to develop the concept the authors touched upon in paragraph 2.4, namely to set a mismatching standard in terms of probability of insolvency, weighted by a probability distribution of various economic conditions.

In the discussion in the 'other place', on the authors' earlier paper, I drew attention to the range within which the yield ratio has moved over the last 20 years, and went on to suggest that it would be appropriate

to adjust the equity values to reflect the average of this ratio, and thereafter to test for equity movements to reflect a change of + or -3% in the fixed interest yield, rather than the arbitrary -25%. At that time, one of the other speakers rightly pointed out that he was older than I, and he recalled the days before the reverse yield gap. I point out the working rule hardly caters for a return to those situations.

The authors considered the treatment of some other forms of assets, and I share their concern about property. It is only when a property is sold that its market value is established. The valuation of property holdings reflect an individual's view, which will rarely coincide with the price the property will achieve on the sale. The lower volatility in the valuation of property portfolios is probably a reflection of this factor. The rule should bear in mind the fact that properties are less marketable. The scenario envisaged by the Regulators is one where the life assurance company is forced to realise its investments in a very short time, in which case as regards property, a drop of more than 25% may well be conceivable.

I was surprised that the authors state that no change in the value of non-interest bearing assets need be assumed. Although it appears logical to avoid hypothecating such assets to any of the liabilities, if any were, I would have thought they should be subject to the -25% test. I realise this would have the effect of pushing up the yield, but if the drop in asset value exceeded the corresponding drop in liabilities, I feel that a mismatching reserve should be set up.

Although they touched upon currency mismatching, I would have welcomed the authors' views on wider aspects of non-sterling assets.

Dealing first with mismatching provisions, I believe that the authorities expect provision for any currency mismatching in respect of non-sterling assets to be of the order of 25% of the amount involved. This would appear to be as arbitrary as the parameters in the working rule. Before I was aware of the G.A.D.'s views on this subject, I had looked at the problem by considering the probability of various levels of currency movement, and came up with a significantly lower percentage. I agree with Mr Jones that further work is desirable in this area.

This leads me onto another aspect of the legislation to which Mr Kirkpatrick has referred, namely that not more than 20% of the liabilities can be mismatched by currency. As mentioned by Mr Kirkpatrick, we criticised this restriction in our paper to the 23rd ICA. The restriction was criticised on two grounds.

Firstly, that it specifies that at least 80% of assets must be expressed in the same currency as the liabilities. For most UK companies, this means sterling assets for the bulk of their business. In practice many investments that meet this criteria are either invested directly in non-sterling assets, for example some Investment and Unit Trusts, or indirectly via companies which either export or operate overseas, and thus their earnings are dependent on fluctuations in the value of sterling. Approximately 45% of the earnings of UK industrial companies arises effectively from such companies. There are also instances of stocks of some companies, for example, Royal Dutch Shell, being denominated in more than one currency, the earnings being independent of the denominated currency, but if you have stock in the wrong denomination, it counts against the 20% limit.

The other aspect to which we drew attention, and on which Mr Kirkpatrick has commented this evening, concerns the fact that a balanced portfolio with wide geographical distribution can generate not only a better investment return, but more importantly, a less volatile return. In this context, we should not overlook the fact that we are in the insurance market, and this means spreading the risk. Should this concept not be extended to the geographical distribution of assets also?

I have already questioned the arbitrary nature of the 25% test, and my comments on overseas investments also leads me, like Mr Jones, to question the suitability of the test to all equity markets. Should the test not have regard to the stability of the markets in which the fund is invested?

Perhaps the Joint Actuarial Working Party could do some further research on this aspect, both with regard to Regulation 25 and to the level of mismatching which is desirable.

Mr Robinson mentioned that he hoped that there would be some discussion on reasonable expectations. Several speakers rose to his bait. Like Mr Scott, I feel that it is a subject for fuller discussion than is possible tonight. I also agree with Mr McBride and Mr Sheddon that policyholders expectations go beyond the level mentioned in the paper. In any event, I feel that having regard to the risks that the with profits policyholders are asked to run, bearing in mind that not all their benefits are guaranteed, they could surely justify a higher level of expectations than provided for in the wording mentioned in the paper.

There have been a few comments on the stochastic method the authors have carried out to test the effectiveness of working rule. In 5.15, they explain the significance of the various headings that appear in Appendix 8. I may have misunderstood their working but it appears that they have restricted the valuation

rate to 7.2%. This restriction conflicts with my understanding of Regulation 59. I believe that in some instances, they could have assumed a higher interest rate, which in turn would have led to a lower asset requirement, and a higher probability of ruin, which in turn questions whether the working rule is adequate.

One or two speakers, including Mr Anderson and Mr Pook, referred to the need to consider taxation implications. Mr Anderson made specific reference to the tax liability under Case VI, and Mr Pook also drew attention to the changes envisaged by the Finance Act 1989.

I personally would go further and say that we may well have to rethink many of the valuation rules that we have been discussing this evening against the background of the identification of assets that may well emerge once the changes in life office tax becomes effective next year. They are areas in which the industry has been in discussion with the Revenue, and until the details are known, it will hardly rate discussion, but I think the changes may well become necessary.

I agree with several speakers, in particular Mr Shedden and Mr Jones, who put in a plea to replace the net premium method with a more coherent method which would deal with various aspects of the problems we have been discussing.

In conclusion, I would like to thank the authors for their paper which has led to a stimulating discussion this evening. As mentioned, I believe there is further work the Joint Actuarial Working Party could usefully undertake in the area of these regulations, and if they take up those suggestions, I look forward to the next paper in this series. I was however, disappointed to learn that the present band of authors are being disbanded. Hopefully they can be replaced.

Mr D. E. Purchase, in response, said: Thank you for such a fascinating discussion and for such a warm welcome.

The discussion tonight frequently suggested that you wish the Working Party had paid more attention to a large number of areas that we have touched on briefly in this paper. I wonder flicking through 94 pages whether you really mean that?

I have to say that the Working Party, when it was set up just over three and a half years ago, had a fairly wide ranging brief and for that reason, members from a wide range of experience. In particular, we had people with skills in unit linked, with skills in with-profits, with consulting backgrounds, one member from the G.A.D., and a Chairman who was deemed to know nothing about any of them, and that is why he is here replying tonight.

But more seriously, I think that many of the comments that have been made tonight will be of inestimable value in helping the new Working Party or Parties as they start their work. I cannot however, let my own Working Party die without one or two comments on some of the things that have been raised this evening, but I must preface those remarks by saying that from now on, this is David Purchase talking, this is not the Valuation Regulations Working Party talking.

A number of speakers commented, as indeed they did at the other place on whether it was reasonable or relevant to carry out a resilience test in the "big bang" situation. I think it is right that there is a test which considers what happens if conditions change very quickly, so that an office cannot adjust to take account of the new conditions in time; firstly, because we have seen that such rapid changes can occur and some would think they are rather more likely in the future than hitherto, and secondly because, with large funds, even if changes can be predicted, it is not actually practical to arrange matters in time.

Perhaps I would use that same argument in reverse as my answer to Mr Elliott, who commented about the potential dangers of sudden switching into a more risky portfolio of investments.

I was very interested in the comments from Mr Kirkpartick and others about whether we were right to insist on currency mismatching. I confess to an intuitive feeling that we are, but I do not think that I want to make a dogmatic statement at this stage.

An early speaker suggested that where we suggested the lowest yielding assets could be omitted for the purpose of determining the resilience reserve, that this was contrary to the regulations. It does not seem a very sensible use of the matching test if two offices which are otherwise identical, but the first one has in addition £200 million of cash, has therefore to use a more stringent test to determine its mismatching reserve.

As I expected quite a number of comments were on the subject of with-profit business and reasonable expectations. This is of course, one of the most important areas and one which we did not investigate in any detail, and I am quite certain it will form a major part of the brief of new working parties, and I won't say any more here except to lend my support to those who suspect that we think (unlike the opener) that terminal bonuses do form part of reasonable expectations.

For a long time in this evening's discussion, I thought that the academic respectability of our stochastic approach was going to emerge completely unscathed, which it certainly did not do in the other place; however we did have one brief skirmish round the value of the Wilkie model for the purposes of the work that we have carried out. I still believe that the investigations that are in the paper in Section 5 and Appendix 8 are of some value in giving some feel for the effects of stochastic variation, but it's certainly not the end of the story.

A fascinating comment was made by Mr Pike as to whether we were right to have ignored linked business in the second paper, having covered it in the first, and indeed we did have some interesting discussions in the Working Party on when it was reasonable to allow for inter-relation between sterling reserves on linked business and reserves for conventional business, such as temporary assurance. There is perhaps some useful work that could be done there at least by those offices that are concerned with it.

There were comments made about the net premium valuation. We are stuck with some fairly inconsistent constraints on our valuation, we have a market value of assets; we have a net premium value of liabilities. As 10 of the other 11 member states of the European Community seem to know of no other way of valuing liabilities, I think pleas to do away with it are likely to be fruitless, even though I might personally support them. However, it is worth adding that we clearly have to consider some special cases, and this is on the agenda for the next working party to modify the current approach, as the net premium valuation is not carrying out what it was intended to with some of the new types of with profit contract, whether they be unitised funds or single premiums.

The Valuation Regulations Working Party has been terminated. It has been terminated twice, actually; it was terminated once by the President of the Institute in a letter to me in May. Well, I knew that could not be right, but when in August I got a letter signed by both Presidents, I felt there was actually no doubt that we had been laid to rest. Nevertheless, we are delighted to have had this opportunity for a final epilogue, and if the main value of our work has been to identify all the questions that really we should have been asked three and a half years ago, when we were set up, then I think our work will have been worthwhile. I suspect that all members of the Working Party will now share my hope that we are finally about to rest in peace, and on behalf of the Original Valuation Regulations Working Party, thank you.