

THE EFFECTS OF SOLVENCY MARGINS ON U.K. LIFE COMPANIES

A guide to life solvency margins, their effect and mitigation

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1. INTRODUCTION

1.1 THE requirement for a United Kingdom life office to hold solvency margins in addition to its normal actuarial reserves took full effect on 15 March 1984. At the time of writing, solvency margins for U.K. life offices have therefore had an effective life of under two years.

Before the introduction of the regulations, many comments were made within the life insurance industry about the effects which the introduction of the life solvency margins would have on the financial position of U.K. life offices. This therefore seems an appropriate time to reflect on the theoretical financial consequences of solvency margins from the point of view of a U.K. life company, and comment on the practical effects which have been observed to date.

1.2 The regulations concerning the calculation of solvency margins and the level of assets needed to support them are contained in a number of official documents which cover both legislation and regulations which expand on the legislation. We have therefore summarized the main rules in a form which we hope is both comprehensive enough to meet the requirements of anyone needing an introduction to the subject, while at the same time being concise enough to be read in a reasonably short time. This summary is covered in §2 of the paper, together with the Appendix.

1.3 Section 3 of the paper looks at the theoretical effects which the existence of solvency margins could have on the financial position of a U.K. life office. Comment is also made on the practical effects which have been observed so far, as shown by the actual behaviour of life offices in response to the introduction of the margins.

1.4 Section 4 of the paper concentrates on ways in which offices can mitigate the effect of solvency margins on their business. These steps include fairly obvious ones concerning contract structure and rating, and also somewhat less obvious schemes which attempt to ameliorate the effect of solvency margins by adjusting the financial structure of the company.

1.5 Section 5 covers briefly some possible changes to the rules which might be considered in the future. However, the chief purpose of the paper is not so much to be prescriptive in terms of suggesting revised rules, as to offer practical suggestions based on what the rules now are. For a comprehensive critique of the

rules, readers are referred to the paper produced by the working party of the Faculty of Actuaries entitled 'The Solvency of Life Assurance Companies'. This was submitted to the Faculty on 8 October 1984. Some brief comments on the conclusions of the Faculty paper are included in § 5.

1.6 Finally, § 6 presents some brief conclusions based on the ground covered in the paper.

2. SUMMARY OF THE SOLVENCY MARGIN RULES

2.1 The regulations for solvency margins are contained in the following documents:

- (i) *Insurance Companies Act 1982*. This Act consolidates the Insurance Companies Acts of 1974 and 1981. The 1981 Act was the legislation which introduced solvency margins, although the consolidation into the 1982 Act means that the latter has now become the definitive legislation.
- (ii) *The Insurance Companies Regulations 1981*. These regulations cover the details of the way in which solvency margins are calculated and applied.
- (iii) *The Insurance Companies (Accounts and Statements) Regulations 1983*. These cover the documentation required for returns to the Department of Trade and Industry (DTI), and include the forms which need to be completed in connexion with solvency margins.

2.2 In addition to the legislation and regulations, the DTI issued a guidance note on 5 October 1984, which gives further details about the use of implicit items to meet the required solvency margins. Also, the Institute's own note on 'The Duties of Actuaries and Professional Conduct' includes a section on solvency margins. This is reproduced on pages 52 and 53 of the 1985–6 Institute Year Book. The note is concerned with the action which an actuary must take under certain circumstances, rather than the actual rules themselves.

2.3 In the interests of brevity and readability, a very short summary is now given of the main requirements of the regulations. The Appendix contains a rather more detailed summary of the solvency margin requirements. General insurance solvency margins are not considered in this paper, although they may apply to certain rider benefits to long term contracts.

2.4 For U.K. life offices, adequacy of solvency margins must be demonstrated in addition to meeting the normal valuation regulations.

The required margin is the sum of two parts, known respectively as 'first calculation' and 'second calculation' required solvency margins.

Firstly, solvency margins need to be set up which are related to the mathematical reserves. For many classes of policy, the solvency margin is 4% of the mathematical reserves. However, this is reduced under certain circumstances for linked long term business and pension fund management business where the office bears no investment risk.

Secondly, there is a required solvency margin of 3% of the capital at risk. This

is defined as the amount payable on death under a policy less the mathematical reserves.

Where business is reinsured, for a given class of business the solvency margin based on capital at risk can be reduced proportionately to the amount reinsured, subject to the solvency margin for the ceding office being no less than 50% of the solvency margin before reinsurance.

For the solvency margin relating to mathematical reserves, some allowance for reinsurance can also be made, in proportion to the reserves for business ceded. However, the solvency margin in this case cannot be less than 85% of the solvency margin before reinsurance.

There are certain concessions for pure reinsurers. The percentage applied to the capital at risk is reduced from .3% to .1%. In addition, the offset allowed in respect of the first calculation can be up to 50% for a pure reinsurer, compared with 15% for a direct office.

2.5 The following explanation of some frequently used terms may be helpful.

- (i) *The required margin of solvency* is the margin calculated according to § 2.4 above, which a company needs to be able to demonstrate.
- (ii) *The required minimum margin* is the greater of the required margin of solvency and the minimum guarantee fund (see §§ 2.10 to 2.12 of the Appendix).
- (iii) *Mathematical reserves* are those reserves set aside to meet future liabilities under long term contracts.
- (iv) *Capital at risk* is the amount payable on death less mathematical reserves. Negative capital at risk is put at zero.
- (v) *Explicit items* are those which can be used to cover the required solvency margin which do not require prior approval of the DTI.
- (vi) *Implicit items* are those which can be used to cover the required solvency margin provided prior approval for their use has been granted by the DTI.
- (vii) *The margin of solvency* is the total of the explicit and implicit items which is available to meet the required minimum margin.

3. THE MAIN EFFECTS OF SOLVENCY MARGINS

3.1 The introduction of the requirement to hold solvency margins with effect from 15 March 1984 has had and will continue to have implications for every U.K. life company. It is now clear that the practical impact varies widely depending on the particular circumstances of each office. Some companies, such as those writing mainly traditional with-profits business, are most affected by the requirements to hold a percentage of the mathematical reserves. Others, such as the pure reinsurers, may be relatively unaffected by the first calculation whereas the second calculation related to the capital at risk can present real problems.

In this part of the paper we shall be considering the theoretical and practical

effects on the corporate position of an office as well as on the different categories of business. We look initially at the various product types, and then go on to draw some broad conclusions in an office context.

3.2 Firstly, by way of introduction, one or two comments about the nature of the requirements may be helpful.

The two calculations required to produce the solvency margin are fundamentally different in their incidence. The first calculation, being reserve related, will normally increase, in line with the reserve required from time to time. For traditional endowment or whole life contracts this will lead to a steadily increasing requirement, although for immediate annuity business the reverse will apply. For term assurances, the result of the first calculation will be trivial compared with that of the second calculation.

By contrast, the second calculation will, for a policy with a level or decreasing sum assured, require the largest margin at outset with the possibility of a steadily reducing requirement for endowment or whole life contracts the longer the policy stays on the books. For level term assurance products, where the reserve at any time is small in relation to the capital at risk, this margin will remain virtually constant. It will also have an adverse effect on new business strain for term assurances. In the extreme case, the second calculation result will be several years' premiums at the younger ages.

3.3 The same overall pattern will apply for linked and non-linked business. The main factor determining the relative significance of each calculation will be the balance between the savings and protection elements within each product type. In this context, of course, annuity business will fall into the savings category.

The methods by which the two diverse requirements can best be met will be explored in more detail in the rest of this section.

Traditional permanent contracts with investment guarantees falling within Class I of Schedule 1 of the Insurance Companies Act 1982

3.4 These will include with and without profits endowment and whole life assurances and their derivatives e.g. low-cost endowments.

3.5 For the shorter term policies in this class, the first calculation margin will be the more significant factor. The second calculation margin will only be significant for whole life contracts and for very long term endowments.

For new business, the effect of having to set up a solvency margin should, in theory, be reflected in the terms offered. Whether or not this needs to be done in practice will depend upon the available margins of the office based on its existing business and financial resources. Most large with profits offices have margins which are very large in proportion to their long term liabilities. The available margins in such cases are often a high multiple of the required solvency margin. The office will therefore be able to write a very substantial volume of new business before any practical constraint is met. Also, there is no reason why the

existence of solvency margins alone should have any effect on the bonus rate of such an office.

3.6 For an office which is not in such an enviable position, and which finds itself constrained by the absence of generously available financial resources, whether explicit or implicit, the situation is somewhat different.

Insofar as there is scope for some weakening of the valuation basis used prior to the need to demonstrate solvency margins this would seem to be a fairly obvious immediate solution. The Government Actuary's Department (GAD) has indicated that there is no intrinsic reason, given the purpose of the solvency margin, why some weakening should not be permitted provided that the valuation regulations can still be met.

If this is either not acceptable or not possible, some weakening of bonus policy would certainly have the effect of releasing the extra resources required for the solvency margin although such a course of action may not be desirable from a marketing point of view. Either of these courses of action would be appropriate for the first solvency margin calculation while not meeting the requirements of the second calculation.

3.7 The existence of the second calculation generally requires a theoretical increase in premium rate. The possible exception to this rule is with profits business, where the existence of the bonus gives an implicit margin that may make a contract self-financing for solvency margin purposes. If neither of the solutions indicated in § 3.6 is acceptable, the increase would need to be greater in order to cover the provision of the first calculation margin as well as the second.

For an office which can meet the required margin adequately but not easily, the question is one of return on shareholders' capital or, in the case of a mutual office, the rate of return required on policyholders' funds. Clearly if assets have to be earmarked to meet solvency requirements they cannot also be used to finance new business presumably being transacted on a rather higher rate of return.

Some specimen calculations for an annual premium contract are shown in Table 1 and suggest that the difference in premium rate for typical whole life and non-profit endowment assurances is unlikely to be large in percentage terms.

3.8 If we consider this group of contracts from the point of view of existing business, we can see that the same principles will apply. However, the practical impact will arise from any need there may be to divert capital to cover the

Table 1. *Annual premium per mille to give the same present value of profit using a risk discount rate of 15% per annum*

Policy	Age	No allowance for solvency	Full allowance for solvency	Ratio	Difference
10 year non-profit endowment	30	90.00	92.50	1.028	2.50
25 year non-profit endowment	40	26.25	26.80	1.021	.55
Whole Life	30	8.30	8.45	1.018	.15
Whole Life	40	13.70	13.90	1.014	.20

solvency requirement which could otherwise have been used to support new business production. Since the policies will already be on the books there will be no explicit allowance in their terms for the provision of a solvency margin.

If the company is to be in the same position after the introduction of solvency requirements as it was before, one of the solutions mentioned in § 3.6 may need to be adopted.

Temporary assurances including group life cover falling within Class I of Schedule I of the Insurance Companies Act 1982

3.9 In general the first calculation will have far less effect on premium rating than the second calculation for these contracts. The effect of the second calculation will be significant, particularly at the younger ages. Indeed, the requirement to hold solvency margins has given further impetus to the whole debate about the 'correct' basis to use for deriving temporary assurance premium rates. This is a subject which has had some exposure recently and we do not propose in this paper to go over ground which has already been adequately covered elsewhere. However, as with so many aspects of solvency requirements, the impact will vary widely from office to office depending on the particular circumstances of each.

3.10 An office which expects to write relatively little individual temporary business as a proportion of the total, may well take the view that term assurance rates should be calculated on a marginal (or near marginal) costing basis. On the assumption that adequate free reserves would be available and that the office is prepared to 'wear' any loss of return on assets which need to be earmarked for solvency purposes, the premium basis might in the extreme make no allowance at all for solvency requirements.

On the other hand an office wanting to write large volumes of term assurance business may need to make full allowance for the solvency requirements. This need would obviously be least for a large with profits office with substantial free assets. Given the state of the term assurance market at the present time, it is unlikely that premium rates making full allowance for solvency margins would be competitive.

3.11 This highlights the dilemma for offices wishing to operate in this sector of the market. There has been no evidence of any upward movement in term assurance rates since the introduction of solvency margins. To offer reasonably competitive rates, offices are therefore forced to adopt something approaching a marginal costing basis and this is unlikely to prove attractive to shareholders (or to with profits policyholders, in the case of a mutual) unless a marked improvement in mortality can be assumed. It would be unwise to rely on such a trend.

3.12 For new business, offices should consider making allowance for the cost of servicing the solvency margin requirement in deriving premium rates. If the effect of writing new business is likely to be so great that further capital injection

Table 2. *Annual premium per mille for a level term assurance to give the same present value of profit using a risk discount rate of 15% per annum*

Age	Term	No allowance for solvency	Full allowance for solvency	Ratio	Difference
30	10	1.60	2.00	1.250	.40
30	20	1.95	2.25	1.154	.30
30	30	2.85	3.15	1.105	.30
40	10	3.05	3.40	1.115	.35
40	20	4.40	4.75	1.080	.35
50	10	7.50	7.90	1.053	.40

is required then the full cost of this capital should be allowed for, net of any return from the assets in which the extra capital is invested. If this course of action has to be followed the effect on premium rates at the younger ages will be marked, as indicated in Table 2. It is unlikely that the margin required as a result of the first calculation would require more than a modest weakening of the valuation basis. Even if this is not possible the extra reserving requirement should not be too onerous except possibly at the higher ages and longer terms.

3.13 The most severe effects arising from this class of business have been experienced by the reinsurers. Even with the concession for pure reinsurers they have faced a heavy burden in respect of existing business, resulting almost entirely from the effect of the second calculation requirement. For new business, allowance can be made in the terms quoted, but even so, close monitoring of the solvency position on an overall office basis is still required.

Reinsurers have experienced a particular problem when quoting for the reinsurance of temporary assurance business on original terms. If the cedant is a large with profits office with no real constraints arising from solvency requirements, it can become very difficult for a reinsurer to quote acceptable terms.

A further complication for reinsurers based in the U.K. is that they are placed at a disadvantage as compared with reinsurers based overseas, particularly in other parts of Europe. This is because the E.E.C. Life Directive does not specify that reinsurers have to be subject to solvency margin requirements. In other European countries there is no solvency margin requirement in respect of a reinsurer.

3.14 Most of the comments made with regard to term assurance also apply to group life risks. In addition there is now an even greater incentive to offer rate guarantees of no longer than two years. Not only is there then no stamp duty requirement, but for cover which is guaranteed for more than three years there is a heavier solvency margin requirement in respect of the capital sum at risk. Because the group life sector is a competitive one, companies will obviously wish to keep their solvency requirements to a minimum. It is unlikely that the reserve related calculation will present problems for short term risk business like group

life but the second calculation could have a significant impact on the overall solvency position if large volumes of this type of business are written.

Individual unit-linked contracts falling within Class III of Schedule 1 of the Insurance Companies Act 1982

3.15 The impact of solvency margin requirements for these contracts can again vary widely. At one extreme, for an investment orientated contract where the office bears no investment risk, the fund management charges are not limited and the capital sum at risk is at a minimum level (for example, a qualifying maximum investment plan) the solvency margin requirement is likely to be very modest indeed.

On the other hand, for a maximum cover new generation flexible whole life contract (which is not very different from the traditional term assurance product) the impact of the second calculation can be significant. Offices now need to pay more attention to solvency margin requirements at product design stage than for earlier contracts, which had a heavy investment bias.

The considerations will be similar to those already discussed in §§ 3.4 to 3.14. One major difference is that these products are likely to be sold in much greater volumes than term contracts and therefore form a much more important part of a company's product range. This will apply in particular to the newer unit-linked offices.

3.16 For companies with free capital it may only be necessary in a profitability study to allow for the loss of return on the solvency margin. If large volumes of high solvency margin business are being sold then model office-type projections should also be made in order to ensure that there will not be a requirement for further capital injection since this will have an impact on profitability. For companies in a less favourable capital position, profit testing should take account of the extra capital required to cover the solvency margin as well as the cost of servicing that margin.

Examples of the impact on a flexible whole life contract of taking the latter approach are shown in Table 3. These projections have assumed that sterling reserves will not have to be set up at any time during the life of the policy. However, it has now been confirmed by the GAD that if such reserves are required, they will attract a first calculation requirement identical to that applying for the unit reserve.

3.17 One problem with the latest generation flexible unit-linked whole life contracts is the potential variability in the level of cover. Quite clearly this could have a significant impact on solvency requirements and therefore the likely profitability of the contract. For example, a maximum cover version will have a heavy second calculation requirement at outset but if cover is subsequently reduced to a more modest level there will be a significant beneficial effect on the overall profitability of the contract from the company's point of view. Conversely, a low cover version which is subsequently altered to provide far

Table 3. Present value of future profits discounted at 15% per annum expressed as a percentage of one year's premiums and break-even point for contracts offering different levels of life cover

<i>Age</i>	<i>No allowance for solvency (%)</i>	<i>Break-even point (months)</i>	<i>Full allowance for solvency (%)</i>	<i>Break-even point (months)</i>
<i>Maximum cover version</i>				
30	44.1	24	1.4	110
40	48.5	21	30.6	34
50	48.7	22	41.4	28
<i>Standard cover version</i>				
30	48.4	17	32.2	26
40	45.6	17	37.5	22
50	42.7	18	38.8	21
<i>Minimum cover version</i>				
30	49.4	12	46.7	16
40	42.6	12	40.5	16
50	35.0	16	33.6	17
<i>Nil cover version</i>				
30	49.9	11	49.9	11
40	41.5	12	41.5	12
50	29.3	12	29.3	12

greater protection could result in the original profit criteria for the contract not being met.

We suggest that two courses of action are indicated by the potential effects on the office of increasingly flexible products. The first is a more flexible profit testing facility to investigate the likely impact of different product structures both at outset and during the lifetime of the contract. Secondly, far greater attention should be paid to developing model office techniques to study the effects on the solvency requirement if the company writes a certain type and volume of business.

Individual and group Permanent Health Insurance (PHI) contracts falling within Class IV of Schedule 1 of the Insurance Companies Act 1982

3.18 For business written in the long term fund, only the reserve-related calculation applies. For traditional individual permanent health insurance contracts no particular problems should be encountered. In general, volumes of business are low in relation to other classes and even where the PHI portfolio forms a rather more significant part of a company's operations there may well be scope for meeting the solvency margin requirements from within an existing valuation basis.

3.19 Group PHI will present even less difficulty, since the second calculation

will again not apply and reserves held are likely to be small, consisting as they do of an unearned premium reserve plus provision for claims, both incurred and in payment.

3.20 One interesting recent development has been a unit-linked PHI contract for which the legislation does not appear to make specific provision. There appear to be two possibilities. If the contract is written as Class III business, i.e., as a unit-linked life contract, presumably the deductions made to cover the PHI risk will be regarded as Class IV business. Because the investment portion of the contract will come within Class III, it seems reasonable to suppose that the 4%, 1% or 0% margin in respect of the mathematical reserve will apply. Some life cover will be provided, even if this is limited to the value of the fund, and so there may also be a small second calculation solvency margin item.

If, however, the whole contract is written within Class IV, presumably a 4% solvency margin will apply to the mathematical reserve, regardless of the ability to increase management charges or the absence of any investment guarantees. However, there would then be no solvency margin on capital at risk.

Managed pension contracts falling within Class VII of Schedule 1 of the Insurance Companies Act 1982

3.21 No particular problems need to be caused by new business of this type provided that the office offering the contract is careful to avoid all forms of investment guarantee. As with individual contracts these will include any guaranteed annuity option, any minimum interest rate guarantee (for example, on deposit administration-type contracts) and any capital value guarantees (including deposit funds where it is guaranteed that unit values will not go down). There is also the need to avoid any limit on fund management charges. In the context of managed pension funds this may present rather more of a problem since very large sums of money can be involved. Fund charges are usually very low, so any need to service a solvency margin could have a severe impact on the office's financial position.

3.22 For existing business, problems may arise from the requirement to hold either a 4% or 1% reserve-related margin.

Annuity business falling within Class I of Schedule 1 of the Insurance Companies Act 1982

3.23 In general a second calculation requirement may arise only for capital protected annuities and during the guarantee period of other annuities. For practical purposes an office's main concern will be with the first calculation. Since investment guarantees are inherent in non-linked annuities a 4% reserve will be required. In theory, this should not present any real problems for new business. However, the immediate annuity market can be highly competitive thus squeezing rates and the margins contained in those rates. For existing business

there could be temporary difficulties depending on the amount of business already in force.

3.24 Genuine unit-linked annuities where the annuity payments are met by cancelling sufficient units would seem to fall within Class III (linked long term) and therefore to attract a solvency margin of 4%, 1% or 0% of the mathematical reserve depending on the investment guarantees and/or fund charge limitations applying.

Guaranteed bonds falling within Class I of Schedule 1 of the Insurance Companies Act 1982

3.25 There are no new problems for an office which writes such business on its own account. However, it is worth mentioning that for guaranteed bonds which are wholly reinsured, the efficiency of the deal may be impaired by the introduction of solvency margin requirements. This results from the restriction that the maximum offset of the reserve-related margin for reinsurance purposes is 15%.

However, since the offset is available on a class basis, an office which does not insure a lot of other business may be able to take full credit for reinsurance of guaranteed bond business.

Summary

3.26 To sum up, we can say that the solvency margin requirements have a widely varying impact depending on the types of product most prominent in a company's portfolio and the free reserve position of the office.

Table 4. *Results of a survey of the DTI returns relating to 58 companies*

<i>Solvency margin as a percentage of the free assets available to meet it (%)</i>	<i>Number of companies</i>	<i>Associated mathematical reserves (£bn)</i>	<i>Mathematical reserves as a percentage of the sample total (%)</i>
0-10	8	16.2	28.6
11-20	11	16.4	29.1
21-30	3	1.6	2.8
31-40	7	9.0	15.9
41-50	7	3.8	6.7
51-60	2	.1	.2
61-70	4	3.8	6.8
71-80	3	1.6	2.8
81-90	8	1.9	3.4
91-100	5	2.1	3.7
Total	58	56.5	100.0

Relatively few offices out of a sample we took in 1985 experienced any difficulty in meeting the requirements at the last year end for which DTI returns were available (in most cases, as at 31 December 1984).

The results of the survey are summarized in Table 4 (above). As might be expected, the ease of meeting the solvency requirements is broadly in proportion to fund size. Only six companies in the sample resorted to the use of implicit items and in every case this related only to future profits.

3.27 It will be interesting to see whether the same pattern will continue in the future. One fact which has been clearly demonstrated by a consideration of the effects of new and existing business is the need for regular monitoring of an office's corporate position using model office techniques. We think that there will need to be much more development work in this area over the next few years.

4. THE MITIGATION OF SOLVENCY MARGINS

4.1 It has already been noted that the effect which solvency margins have on offices varies over a wide range. At one extreme, the regulations have no practical effect at all for a large with profits office with substantial free assets. At the other extreme, there could be a critical limitation on an office's operations in the case of a non-profit office with low assets and lack of readily available extra capital.

4.2 For an office which has problems in meeting its solvency margin requirements, there are a number of steps which can be taken. These can be broadly divided into two areas—those involving contract rating and design, and those involving the financial structure and management of the company. These areas of possible mitigation are considered below.

Which methods will be most attractive to any particular office will obviously depend on a number of factors. These include the market feasibility of contract or rate changes, the degree of seriousness of the solvency margin problem, the availability of capital, and the wishes of existing shareholders concerning the future of the company.

After considering separately the areas for mitigation, there is finally a section concerned with the steps which an office may need to take if it is unable to demonstrate the required degree of solvency.

Mitigation by contract rating and design

4.3 Ostensibly, the most obvious way to mitigate solvency margins would be to take account of their cost in the basis for premium rating. For products rated using conventional premium formulae, it is generally not a particularly straightforward matter to build in the extra cost of solvency margins. If extra capital is available to the office, the cost of solvency margins can be looked on as the difference in yield between what is obtained on the assets in which the capital is invested, and that which the shareholders could reasonably expect if solvency margins did not exist.

For products with low reserves, such as term assurances, the effect of the second calculation solvency margin would then be a fixed addition per £1,000 sum assured per annum. The cost of the first calculation solvency margin would, in such circumstances, be negligible. Where reserves are not trivial, the cost of the second calculation solvency margin would then reduce over the contract term, while the cost of the first calculation margin would increase. It would therefore be necessary to build the reserving basis into the calculation.

Apart from term assurances, the most flexible approach would therefore seem to be to take account of the cost of solvency margins using profit testing techniques. This approach can be applied to all forms of contract, including unit-linked products, where there is in any case no real alternative.

4.4 The use of profit testing enables solvency margins to be included as another component in the projection. This approach also allows for the solvency margins to be released on lapse, surrender, death or maturity. Ideally, a profit testing program should allow for the possibility of a different rate of interest on solvency margin assets compared with that earned on the sterling reserves.

Because there is no legal requirement for solvency margin assets to be invested in any particular way, it would be possible using this approach to allow for a variety of different rates of return depending on the assets.

It is likely to be most appropriate to invest in the underlying unit fund for first calculation margins in respect of unit-linked contracts. However, the risk attaching to, for example, equity investments for solvency margins for non-linked liabilities is obvious, as a fall in asset values could result in an office's solvency margin disappearing overnight.

4.5 In spite of the reduction in profitability of business written on existing rates there has been no apparent move in the market to take account of solvency margins in premium rates. This is understandable, bearing in mind that for most kinds of product, offices which may have a real solvency margin problem are likely to be competing with large with profits offices, or their subsidiaries.

4.6 It obviously makes sense for future product developments to take account of the solvency margin rules so as to try to minimize the adverse financial effect on the office.

It is difficult to avoid the second calculation solvency margin, as this is based on the capital at risk and no allowance is given for a reduction in this risk by, for example, having a very weak rate guarantee. Many of the new generation of flexible unit-linked contracts offer no guarantee as to the level of the mortality deduction to the policyholder. Even though the mortality risk in such a case is obviously less than where a lifetime guarantee is given, no reduction in the second calculation solvency margin is allowed.

However, there is scope for reduction or elimination of the first calculation margin. The most important factor is the removal of any investment risk from the office. While the most obvious form of investment guarantee is a maturity guarantee, there are a number of other more subtle ways in which an office can assume an investment risk. These include annuity options, minimum rates of

interest on deposit administration contracts, guaranteed funds, and so on. Since such features are particularly common with pension contracts, it can be rather easier to mitigate the effects of solvency margins on life contracts than pensions contracts. If, in addition to the elimination of any investment risk to the office, there is no limitation to possible increases in management charges, the first calculation solvency margin factor is reduced from 1% to 0%.

For term assurance contracts the limitation of term to five years or less results in a very useful reduction in the solvency margin factor applied to the capital at risk from ·3% to ·15%. With a term not greater than three years, this can be further reduced to ·1% of the capital at risk. Three or five year renewable term assurance is the obvious way to take advantage of this concession, as the solvency margin rules do not take account of the existence of any options for extending or increasing the cover under contracts.

4.7 Another possible strategy to reduce the burden of solvency margins is to consider the marketing of contracts which by their nature, have a lower level of solvency margin.

Permanent health insurance contracts have a solvency margin based only on the mathematical reserves, and which takes no direct account of the risk element of the contract. Typically, the solvency margin requirement for PHI may be no more than 10% of premium.

By contrast, a level term assurance contract with a term greater than five years would have a solvency margin requirement of £3 per £1,000 sum assured, which for a younger life could be equivalent to several years' premiums.

One other contract type which has a lower solvency margin than many life assurance protection contracts is medical expenses insurance. This is non-life business, which is not considered elsewhere in this paper, and on which the solvency margin is typically 18% of premium.

While the general insurance nature of the contract may make it seem irrelevant to a life office, in marketing terms the product falls very much within the personal protection area. It can be considered alongside PHI and hospital cash contracts as a relatively low solvency margin contract. Clearly, any office wishing to sell medical expenses needs either to be a composite or to set up its own general insurance subsidiary.

Mitigation through financial management and structure

4.8 The most obvious way of meeting solvency requirements is by the injection of further capital from shareholders. This can be in the form of ordinary or preference share capital, but cannot be in the form of loan stock, as this would entail a corresponding liability.

For a company which has a solvency margin problem and is not a subsidiary of a large group, the shareholders may well take the view that the financing of solvency margins is not an efficient use of capital, forcing the office to look at some of the alternatives which are described in this section.

However, the capital injection route is relatively easy for the company which is a subsidiary of a larger group which has substantial free assets well in excess of those required to meet solvency margins. Typically, this would apply to a unit-linked subsidiary of a large with profits company.

Such an arrangement would involve the parent company investing in the subsidiary via additional ordinary or preference share capital. The subsidiary could then invest the capital so provided in precisely the same investments which the parent company would have held within its own fund. The return on the capital could then be fed back to the parent company as group income from the subsidiary.

The overall effect is that the parent company has its money invested in precisely the same investments as before, so that the only cost of the arrangement to the group is related to the setting up and maintaining of the scheme. Stamp duty of 1% is payable on new share capital, but as this is a once and for all item, the annual cost of the scheme probably works out at only a fraction of 1% of the capital provided.

4.9 A number of variations are possible on this basic theme. It would be possible to borrow the money externally and recycle it round through the subsidiary which would then deposit it back with the ultimate lender.

From a cost point of view, the two schemes should be identical. However, the initial loan to the holding company increases the gearing of that company, and is then transformed into share capital at a later stage in the transaction. Even though the money finally returns to its source, the lending institution is still effectively tying up its money so that it cannot be used for other purposes.

4.10 Another way in which solvency margins can be mitigated is by reinsuring a greater proportion of business. The limitation on the amount of credit which can be taken for reinsurance is a constraining factor. However, relatively few companies are anywhere near their limits for reinsurance, particularly as regards the second calculation, so that this strategy has potential attractions in many cases.

The main problem with such an approach is that it is mixing up the financial arrangements of the company with the risk side of the business, so that the company may be giving away business to a reinsurer on which it would hope to make a risk profit. While this conflict will always remain to some extent, the current low level of reinsurance rates generally, plus the possibility of adding profit sharing to the arrangement, means that it is still worth considering.

Because of the lower rate of solvency margin applying to the second calculation for a pure reinsurer, the overall saving in solvency margin costs can be significant.

4.11 If an office is in the position of being able to meet the solvency margin requirements for its existing portfolio of business, but is close to the level where it will run out of assets if it grows at an appreciable rate, one strategy is a reduction in the growth rate of the company. This is obviously something of a last resort, assuming that the office believes it will be able to write business which would be profitable in the absence of the solvency margin requirements.

What happens if solvency margins cannot be met?

4.12 This question is considered here because if an office is considering action to reduce its solvency margin problems, it also needs to know the effects of being unsuccessful in its mitigation strategy.

4.13 The action which results from an office's inability to show the required level of solvency margin depends on the degree of shortfall.

4.14 If the amount available to meet the solvency margin is less than the required minimum margin, but is greater than the amount of the guarantee fund, the DTI is likely to request a plan for the restoration of a sound financial position. It is understood that this means a plan showing how the office will reach the required minimum solvency margin within the next year or so. The Department has the power to ask for modifications to the plan as it thinks necessary, and to require such a plan to be put into effect.

However, the Department also acquires wider powers which it may use if it deems necessary. In the extreme, it can withdraw a company's authorization. It can also limit the premium income which the office writes, give instructions as to the company's investments, have actuarial investigations carried out, and require the production on an accelerated basis of information required under other regulations, as well as having a number of other powers. There is also the residual power, if the DTI considers it appropriate for the purpose of protecting policyholders or potential policyholders, to take unspecified action that it deems fit.

4.15 Where the margin of solvency is less than the guarantee fund but greater than zero, the DTI can ask a company to produce a 'short term financial scheme'. It is understood that this means a plan to restore the margin of solvency to at least the guarantee fund within a short time, followed by a long term plan to restore the full minimum margin. Alternatively, the DTI may call upon its wider powers of intervention as described above.

4.16 If a company has a negative margin of solvency, it is technically insolvent. The DTI will in such a case use its wide powers of intervention to protect the interests of policyholders and future policyholders. Here, the problem is not so much the inability to demonstrate solvency under the regulations as a failure to meet the minimum valuation requirements for an insurance company.

5. POSSIBLE CHANGES TO THE RULES

5.1 As stated in the introduction, our main purpose is not so much to be critical of the existing rules as to describe them and their effects, and to make suggestions as to their mitigation. Reference has already been made, in the introduction, to the paper produced by the working party of the Faculty of Actuaries. The paper's suggestion for a more satisfactory approach is based on the idea of applying computerized simulation techniques to the portfolio of each office, in an attempt to recognize the stochastic nature of expense, mortality and investment experience.

5.2 In spite of the inadequate background to the basis for the current solvency margin rules, they do have the advantage that they are relatively straightforward to apply. There are many other important issues which concern actuaries and senior management of U.K. life offices at the time of writing. These include licensing of intermediaries, disclosure of commission, investor protection, the pensions debate, and the financial services revolution.

We do not believe that the disadvantages of the current regulations are so great as to make it worthwhile dismantling the framework which has now been set up. However, we would like to make some suggestions for relatively minor changes in the rules which would enable them to be applied with greater equity than at present.

5.3 The four main areas of financial risk for an office are those of mortality, expenses, investment, and options and guarantees. Each of these areas is considered in turn.

Mortality

5.4 Appendix 3 to the Faculty working party paper contains some interesting calculations concerning the appropriate level for a solvency margin in respect of mortality risks. The expression derived is based on the assumption that the office is unable to vary the charge it makes for mortality once a policy has been issued.

One of the most rapidly growing sectors of the U.K. life assurance market at the present time is for unit-linked policies under which the mortality cost is met by cancelling units on a monthly basis. Most current contracts give the office wide powers to change the basis for the mortality deduction. It would therefore appear that such companies are carrying a negligible long-term mortality risk, because if the office experiences mortality at a level above that assumed in the charges, it can adjust its rates on existing policies.

There are obviously some practical constraints on doing this. Any office making large increases in its mortality deductions which were not fully justified or which were not of a similar level to charges being made by other offices with similar products, would obviously suffer from a marketing disadvantage for new business and run the risk of experiencing an increased lapse rate on its existing business. There is also the question of the DTI's attitude to such action. It could be argued that the 'reasonable expectations of policyholders' would be that any such increase would not be more than that which could be justified by an office's mortality experience, taking into account the fact that it is possible for an office to have an adverse experience in any one year.

Nevertheless, the mortality risk to such an office is obviously less than that to one which gives a guarantee on its mortality charge for the lifetime of the policy. It is already recognized by the supervisory authorities that where a mortality risk is for a short period, a reduction in the solvency margin based on the capital at risk should be given. It would therefore seem reasonable to stipulate that, in the case of a policy which has mortality charges met by cancellation of units and

where there is no guarantee as to the future level of charges, such a policy could be treated as a term assurance for no more than three years and thus be eligible for the reduced rate of solvency margin on the capital at risk of 1%.

Expenses

5.5 The Faculty working party paper was unable to consider the appropriate level of solvency margin for the risk concerning expense fluctuations. The regulations seem fairly reasonable on this point, with the first calculation margin reduced to nil where an office can increase management charges with no upper limit. However, this only applies to policies where the office is running no investment risk, whereas it is quite possible to have a contract under which the office runs an investment risk but no expense risk. One way in which this could be recognized would be to reduce the solvency margin on the mathematical reserves from 4% to, say, 3% for such policies.

Investment

5.6 Most of the investigations carried out by the Faculty working party concerned the investment risk, looking at non-profit and with profits policies issued by a conventional office. Again, the regulations recognize that a reduced margin is appropriate where the office bears no investment risk, when the rate of solvency margin is reduced to 1% or 0% of the mathematical reserves. This seems a reasonable approach for unit-linked business, whereas for with profits business, the 4% margin applies in full. However, since most large with profits offices have substantial free assets, it is difficult to argue convincingly for a reduction in the required solvency margin for with profits business.

Options and Guarantees

5.7 Those guarantees relating to mortality, expense and investment have already been discussed. The 4% first calculation margin is irrespective of the strength of a guarantee, and applies equally to, for example, a strong maturity guarantee and a very weak annuity option rate guarantee. The real risk attached to such weak guarantees is often negligible, and would justify a reduction in the 4% margin.

No explicit account is taken of options. Since conversion, increase and renewal options are usually based on rates at the date the option is exercised, this seems a reasonable approach.

The treatment of reinsurance

5.8 The final area of inequity in the current rules concerns the treatment of pure reinsurers. The main problem here is one of comparability with similar

companies on the continent. The U.K. is the only country in the E.E.C. which treats reinsurers as insurance companies rather than trading companies for solvency margin purposes. This puts U.K. based reinsurers at a disadvantage compared with their continental counterparts.

5.9 The main problem for pure reinsurers in the U.K. is the rate of solvency margin on the capital at risk, as pure reinsurers generally have a very high proportion of risk-type business compared with a direct office.

Initially, it was intended that the full rate of solvency margin of .3% of the capital at risk should be applied to U.K. reinsurers as well as to direct offices. After representations by the reinsurers, a concession was obtained that the margin would be reduced to .1% of capital at risk for risk premium business. Eventually, this concession was extended to all types of business for companies which qualify for 'pure reinsurer' status.

5.10 While this is obviously a considerable improvement on the initial proposals, a reinsurer whose business is mostly at the risk end of the spectrum still bears a heavy financial burden. If the same burden were laid upon the continental reinsurers, U.K. reinsurers would hardly be in a position to complain.

As a matter of public policy, it seems strange that at a time when it is particularly important for U.K. companies to trade on a competitive basis in world markets, the U.K. alone in the E.E.C. should impose this severe burden on its reinsurers. The effect is to make it considerably more difficult for U.K. reinsurers to obtain overseas business reinsured into the U.K. In our view, pure reinsurers should be treated in the same way as they are in other E.E.C. countries, and the requirement for solvency margins dropped completely.

6. CONCLUSION

6.1 This paper has attempted to summarize the most important aspects of U.K. solvency margin legislation, to demonstrate the main effects on U.K. life companies, and to suggest ways in which the effects can be mitigated. We have also taken the liberty of making some suggestions for changes in the legislation.

6.2 It has already been pointed out that the theoretical basis for the nature and level of current solvency margins is open to question. Nevertheless, we feel that now that the system has been established, the upheaval which would accompany its abolition or wholesale revision would probably not be outweighed by the benefits which might be obtained from a more rational system.

While we appreciate the arguments of the Faculty working party for a system based on a stochastic model approach, we feel that the complications which would ensue from the application of such a system could well outweigh the benefits.

6.3 In recent years, the financial situation of U.K. life companies has generally been relatively healthy. While there are undoubtedly many offices which are not producing the profits that they would like to see, the insolvencies of the early 1970s have not been repeated in recent years. The wide powers available to the DTI to intervene in the affairs of a U.K. life company are frequently used.

The fact that there have been no major insolvencies in recent years, even before the advent of the solvency margin legislation, suggests that the system before the introduction of solvency margins was working satisfactorily. The existence of solvency margins provides a further safety net.

6.4 Reference has already been made to the many other important issues which confront the actuaries and management of U.K. life offices at the time of writing. Overall, we feel that it would be of greater benefit to the industry and to policyholders for us to concentrate on these problems and to learn to live with the solvency margin legislation more or less as it stands, subject to some minor modifications along the lines described in § 5.

6.5 Finally, we should like to thank all our colleagues for their comments and assistance in the preparation of this paper. The views expressed are, of course, entirely our own.

7. BIBLIOGRAPHY

- (1) 'The Solvency of Life Assurance Companies', presented by the Solvency Margin Working Party of the Faculty of Actuaries to the Faculty on 8 October 1984.
- (2) Insurance Companies Act 1982.
- (3) The Insurance Companies Regulations 1981.
- (4) The Insurance Companies (Accounts and Statements) Regulations 1983.
- (5) The Insurance Companies (Amendment) Regulations 1985.
- (6) Guidance note on applications for orders to count implicit items under Regulations 10 to 13 of the Insurance Companies Regulations 1981 in respect of long term business, published by the DTI in October 1984.
- (7) 'Solvency Margins', a paper presented by P. H. Hinton to the Institute of Actuaries Convention at Birmingham on 12 September 1985.
- (8) 'Valuation Returns in relation to Solvency Margins', memorandum to appointed actuaries from the Government Actuary, dated 13 November 1985.

APPENDIX

Summary of solvency margin regulations

1. INSURANCE COMPANIES ACT 1982

1.1 Sections 32 to 35 of the Act form the fundamental legislation on solvency margins. For a U.K. life office, the effect of § 32 is that the office shall maintain a margin of solvency as prescribed in the regulations. Failure to do so means that the office must, at the request of the Secretary of State, submit, modify as necessary, and carry out a plan for the restoration of a sound financial position.

The margin of solvency of an insurance company is defined as the excess of the value of its assets over the amount of its liabilities, with the value and amount of the assets and liabilities being determined in accordance with any applicable valuation regulations.

1.2 Section 33 provides that if the margin of solvency falls below an amount determined in accordance with the regulations, the Secretary of State may

require the company to submit, modify as necessary, and carry out a short term financial scheme for the restoration of the required minimum margin. This is intended to cover cases where the solvency margin available falls below the level of the guarantee fund (see §§ 2.10 to 2.12 of this Appendix), whereas § 32 applies to solvency margins between the required level and the guarantee fund.

1.3 Section 34 is concerned with companies supervised in member states of the E.E.C. other than the U.K.

1.4 Section 35 provides that regulations may cover the form and situation of assets used to meet solvency margin requirements.

1.5 Section 68 of the Act enables the Secretary of State to vary any of the provisions concerning solvency margins for a particular company. The section is intended to apply, among other things, to the valuation of implicit items for solvency margin purposes. It may also be used to reduce the required minimum guarantee fund for certain small mutual offices.

2. THE INSURANCE COMPANIES REGULATIONS 1981

2.1 The regulations are made by the Secretary of State in exercise of powers given to him under the Insurance Companies Act 1982. Part II of the regulations is concerned with solvency margins, covered by Regulations 3 to 13. In addition, Schedule 3 to the regulations covers the rules relating to the minimum guarantee fund.

2.2 Regulation 3 covers a number of definitions. For long term business Classes I and II, the first calculation is defined to be that concerning the solvency margin relating to a percentage of mathematical reserves, after allowing for any reinsurance. The second calculation is that relating to the capital at risk, again after any reinsurance.

Implicit items are those relating to future profits, zillmerizing and hidden reserves. However, these items have no value except in pursuance of an order under Section 68 of the Insurance Companies Act 1982.

The required margin of solvency is defined as being the margin of solvency required by the regulations.

2.3 Regulation 4 states that, for long term business, the solvency margin is determined in accordance with Regulations 5 to 8. For long term contracts with rider benefits which fall within general business Class 1 or 2, the long term solvency margin calculation applies to the long term business part of the contract, while the general insurance solvency margin (not considered in this paper) applies to the general insurance part of the contract.

2.4 Regulation 5 covers the calculation of the required solvency margin for long term business Classes I and II, i.e., non-linked life and annuity business and contracts providing sums on marriage or on birth. The calculation is divided into two parts—the first calculation and the second calculation. The total solvency margin is the sum of the results of the two calculations.

First Calculation

2.5 This concerns the solvency margin calculated by reference to mathematical reserves. The required solvency margin is equal to 4% of the mathematical reserves, but this may be adjusted for reinsurance as follows. Where, at the end of the previous financial year, the proportion of total mathematical reserves represented by business which is retained by the company (i.e. not reinsured) is 85% or less, then the required solvency margin as first calculated can be multiplied by a factor of .85. Where the mathematical reserves retained come to more than 85% of the total mathematical reserves, the actual percentage retained is used instead of the factor of .85. For a pure reinsurer, the factor of .85 is replaced by a factor of .50.

Second Calculation

2.6 This refers to the required solvency margin based on capital at risk. Capital at risk means the amount payable on death less the value of any mathematical reserves. The solvency margin is equal to .3% of the capital at risk. Reinsurance is allowed for in a similar way to that described above for the first calculation. In this case, however, the ratio of retained to total capital at risk at the end of the previous financial year is examined, and if it comes to 50% or less, a factor of .50 is applied to the solvency margin under the second calculation. Where more than 50% of the capital at risk is retained, the actual percentage is applied to the figure from the second calculation.

Initially, there was a concession for the risk premium business only of reinsurers whereby the solvency margin under this section was .1% of the capital at risk.

However, this is now permitted on the full capital at risk for a reinsurer, as confirmed in the 1985 Regulations.

For contracts providing only a death benefit, with a term of three years or less, .3% is replaced by .1%. For terms of between three and five years, the factor is .15%. For a group policy, the term is taken as the rate guarantee period.

2.7 Regulation 6 covers the calculation of solvency margins for long term business Classes III and VII, i.e., unit-linked business and pension management business.

The calculation follows that for Classes I and II described above, but with several provisos, including the following.

- (i) If the insurance company bears no investment risk, the term of the contract exceeds five years, and the management charge in the contract has a fixed upper limit which is effective for a period exceeding five years, then the first calculation is applied using 1% instead of 4%.
- (ii) If the insurance company bears no investment risk, and either the term of the contract does not exceed five years or the management charge is subject

to a fixed upper limit for no more than five years, the first calculation margin is zero.

2.8 Regulation 7 covers the solvency margin for long term business Classes IV and VI, i.e., permanent health and capital redemption policies. The solvency margin applying for these classes of business is simply the first calculation described in §2.5 above. In other words, the solvency margin calculation only takes into account the mathematical reserves under the contracts, and does not relate in any other way to the amount of risk borne under the contract.

2.9 Regulation 8 concerns long term business Class V, i.e., tontines. For such contracts, the required solvency margin is 1% of the assets of the tontine.

2.10 Regulation 9 deals with the requirement for a guarantee fund. The regulation stipulates that one third of the required solvency margin shall constitute the guarantee fund. If the actual solvency margin falls below the level of the guarantee fund, the company can be required by the Secretary of State to submit a short-term financial scheme for restoration of the guarantee fund, and to carry out such a scheme, subject to any modifications stipulated by the Secretary of State.

2.11 The minimum level of the guarantee fund, known as the 'minimum guarantee fund', is specified in Schedule 3 to the regulations. The minimum guarantee fund is an absolute amount, expressed in European Currency Units (ECU), below which the guarantee fund may not fall even if it meets the requirements as a proportion of the solvency margin. Explicit items must be sufficient to cover the greater of the minimum guarantee fund or 50% of the guarantee fund.

For a proprietary U.K. life office, the minimum guarantee fund is 800,000 ECU. For a mutual, the level is 600,000 ECU, and for captive reinsurers, the minimum guarantee fund is 200,000 ECU.

Paragraphs (2) to (5) of Schedule 3 reduced the minimum guarantee fund for certain small mutuals. These provisions were revoked under the 1985 Regulations. Any reduction in the minimum guarantee fund for a small mutual will in future be dealt with by a 'Section 68' Order.

2.12 Under Regulation 2(2)(b) the value of an ECU to be used for the year starting on 31 December is that published on the preceding 31 October. The value of an ECU as at 31 October 1985 was £0.585670. This value will therefore be used to convert between Sterling and the ECU for the year 31 December 1985 to 30 December 1986.

2.13 Regulation 10 covers several points concerning the valuation of the assets of a life office for solvency margin purposes. Generally, the full normal regulations apply to such assets as they would to any valuation. However, there are some additional provisions.

- (i) Where the issued share capital of a company includes some partly paid shares, provided the total paid-up value of all shares is equal to or greater

than one quarter of their nominal value, or in the case of shares issued at a premium, of the total of their nominal value and the premium, an amount not greater than half the total value of the amounts unpaid may be taken into account as an asset. This also applies to a mutual, provided at least one quarter of the fund of the mutual is paid up.

- (ii) In the case of a mutual carrying on general business, any claim which the mutual has against its members by way of a call for supplementary contributions shall have its full value for a financial year subject to the limitation that the value shall not exceed 50% of the difference between the maximum contributions and the contributions called in, or 50% of the required margin of solvency.
- (iii) Implicit items (described below) shall have no value in any valuation to satisfy solvency margin requirements, unless an order has been granted under Section 68 of the Insurance Companies Act 1982. When such an order has been granted, the implicit items may be valued in accordance with Regulations 11 to 13, described below.

2.14 Regulation 11 refers to the inclusion of future profits as an implicit item in the valuation. The valuation shall not take account of more than 50% of the full amount of future profits. This 'full amount' is obtained by multiplying the estimated annual profit by a factor which represents, as closely as possible, the average number of years remaining to run on policies. However, if this factor exceeds 10, it is reduced to 10.

The estimated annual profit is taken to be one fifth of the profits made in long term business over a period of five years (known as the 'relevant period') ending on the last day of the most recent financial year for which a statutory valuation has been carried out. Substantial items of an exceptional nature must be excluded.

The profits for the period are taken to be the total surpluses arising in the long term fund over the period, net of any deficiencies in the long term fund during the period. If an insurance company has not carried on long term business throughout the relevant period, the profits are calculated in accordance with the above rules for the period for which long term business has actually been transacted. The factor of one fifth to be used in estimating annual profit is still used, even though the period is shorter than five years.

2.15 Regulation 12 deals with the zillmerizing of reserves as an implicit item.

2.16 Where zillmerizing is appropriate but is either not practised or is at a rate less than the loading for acquisition costs included in the premium, the implicit item relating to zillmerizing may be valued at an amount not exceeding the difference between:

- (i) the non-zillmerized or partly zillmerized figure for mathematical reserves maintained by the company and,
- (ii) a figure for mathematical reserves zillmerized at a rate equal to the loading for acquisition costs included or allowed for in the premium.

2.17 Where zillmerizing is not practised, then the value given by the above paragraph shall not exceed 3.5% of the total of the difference between:

- (i) the relevant capital sums for long term business, and
- (ii) the mathematical reserves, excluding any such reserves for temporary assurances.

2.18 Where zillmerizing is practised but is at a rate less than the loading for acquisition costs then the value given by § 2.16 above together with the difference between the partially zillmerized mathematical reserves and the non-zillmerized mathematical reserves shall not exceed 3.5% of the total of the difference between:

- (i) the relevant capital sums for long term business, and
- (ii) the mathematical reserves, again excluding any such reserves for temporary assurances.

2.19 The expression 'relevant capital sums' has the following meanings:

- (i) for whole life assurances, the sum assured.
- (ii) for policies where a sum is payable on maturity, the sum payable on maturity.
- (iii) for deferred annuities, the capitalized value of the annuity at the vesting date (or the cash option if greater).
- (iv) for capital redemption contracts, the sum payable at the end of the contract period.
- (v) for linked contracts, the total premiums payable or, if premiums are payable throughout life, the total premiums payable to age 75. This rule was modified in the 1985 Regulations (see § 3.6 of this Appendix).

In all the above cases, any vested reversionary bonuses and any capital sums for temporary assurances are to be excluded.

2.20 Where the payment of premiums ceases before the sum assured becomes due under the above rules, then the 'relevant capital sums' shall be taken to mean the mathematical reserves appropriate for the contract at the end of the premium paying term.

2.21 For the purpose of all the above rules, reserves for vested reversionary bonuses shall not be regarded as mathematical reserves, and the results given under the various rules for calculating the implicit item due to zillmerizing shall be reduced by the amount of any undepreciated acquisition costs brought into account as an asset.

2.22 Regulation 13 concerns the use of hidden reserves as an implicit item. If hidden reserves result from the underestimation of assets and overestimation of liabilities (other than mathematical reserves) they may be given their full value, insofar as they are not of an exceptional nature.

The DTI states that it will not generally consider allowing hidden reserves as an implicit item unless the solvency margin requirements will not otherwise be met.

3. THE INSURANCE COMPANIES (AMENDMENT) REGULATIONS 1985

3.1 These regulations make a number of miscellaneous amendments to the Insurance Companies Regulations 1981. The most important changes having a bearing on the calculation of solvency margins are noted below.

3.2 Regulations 2 and 13 provide that 'deposit back' arrangements are taken into account in valuing the long term liabilities of an insurance company but are excluded from the definition of 'mathematical reserves'. A 'deposit back' arrangement is one where a ceding company reinsures a certain liability with a reinsurer, which then invests the backing assets with the ceding company.

3.3 As noted in §2.4. above, the reduced solvency margin for reinsurers of long term business applies to all business, not just to risk premium business as set out in the 1981 Regulations. This is covered in Regulations 3(1) to 3(5) of the 1985 Regulations.

3.4 The definition of 'capital at risk' is amended under Regulation 3(6) to take account of annuities and instalment payments. This is particularly relevant to the valuation of family income benefit-type policies, as it means that the present value of the payments, rather than their face value, can be taken when calculating capital at risk.

3.5 The calculation of future profits is amended under Regulation 6 so that the average number of years remaining to run on policies is to be weighted by reference to the actuarial value of the benefits.

3.6 Regulation 7 amends the calculation of the relevant capital sum for linked long term contracts for the purposes of valuing implicit items relating to zillmerizing. Instead of basing this on total premiums payable, the relevant capital sum is the lesser of the death benefit and the total of the value of units plus the total amount of premiums remaining to be paid during such of the term of the contract as is appropriate for zillmerizing.

3.7 A number of other amendments to the regulations are made which would need to be considered by an actuary with responsibility for valuing an office's long term business and demonstrating the solvency thereof. However, they are generally of too detailed a nature to be included here.

4. THE INSURANCE COMPANIES (ACCOUNTS AND STATEMENTS) REGULATIONS 1983

4.1 These regulations cover all the documentation which needs to be submitted to the DTI in connection with a statutory valuation and demonstration of adequacy of the solvency margin.

4.2 For solvency margin purposes, the following forms need to be completed:

- (i) Form 9—this covers the comparison of the required minimum solvency margin with assets for both general and long term business and includes details of the required minimum margin, available assets and implicit items.

- (ii) Form 60—this shows the calculation of the required minimum margin for long term business, by each business class, including the first and second calculations and allowing for reinsurance.
- (iii) Form 61—this covers the calculation of the required margin of solvency for accident and sickness insurance which is written supplementary to long term business.

5. GUIDANCE NOTE ON APPLICATIONS FOR ORDERS TO COUNT IMPLICIT ITEMS

5.1 The above guidance note was accompanied by the DTI's letter of 5 October 1984. The purpose of the guidance note is to set out the procedures to be followed in making applications under Section 68 of the Insurance Companies Act 1982 for orders in respect of implicit items under the Insurance Companies Regulations 1981. The regulations concerned are numbers 10 to 13, described in §§ 2.13 to 2.22 above. A brief summary of the most important part of the guidance note is given below. Any actuary with responsibility for the preparation of statutory returns including implicit items obviously needs to study the guidance note in some detail.

5.2 The note states that orders in respect of future profits and zillmerizing will be readily available. However, orders in respect of hidden reserves will only exceptionally be given.

5.3 There is an obvious problem of timing. In an ideal world, orders relating to the position at a given year end would be issued in time for the implicit items to be included in the statement of solvency forming part of the returns relating to the year end. Because of delays within companies in producing the requisite information, and within the DTI in processing the applications for orders, it will often be the case that it will not be possible for an order to have been approved by the due date for submission of the returns to the DTI. Orders in respect of zillmerizing or hidden reserves must be closely related to the basis on which liabilities or assets have been valued. Orders in respect of these implicit items will therefore only be made in relation to the position shown in a particular set of the returns. This means that it will be essential for companies to submit applications to the DTI well in advance of the deadline for the submission of returns.

5.4 For the inclusion of future profits as an implicit item, it will be acceptable for returns to be submitted which demonstrate cover for the required solvency margin on the basis of a current order in respect of a future profits implicit item issued during the course of the preceding twelve months on the basis of information contained in the previous set of returns. However, all such returns must be accompanied by an application, certified by the appointed actuary, for a further order in respect of the future profits implicit item for an amount not less than the amount for which credit has been taken in the returns. Orders cannot be back-dated and may be withdrawn at any time. Careful consideration therefore needs to be given to the submission of such applications to ensure that the DTI

does not have grounds for withdrawing the order if there are doubts about whether or not the amount in respect of which an order has been given can still be justified.

5.5 In calculating the implicit item relating to future profits, the DTI wants to be satisfied that the amount does not exceed the value of the margins in the premiums and the reserves for the existing business which are genuinely available to meet the effects of adverse contingencies which might arise in the future.

The DTI will therefore require an application for a Section 68 Order in respect of this item to be supported by an appropriate certificate from the appointed actuary.

Substantial items of an exceptional nature need to be excluded from the calculation of the estimated annual profit. This would include profits arising from an exceptional change in the value of assets, where this is not reflected in a similar change in the amount of the liabilities, and profits arising from a change in the valuation basis. An exceptional loss may be excluded from the calculation only to the extent that it can be set against profits up to the amount of the loss and arising from a similar cause. However, it is not intended to require an adjustment for the effect on surplus of a net strengthening of the reserves, nor of costs associated with an expansion of business nor special capital expenditure.

The inclusion of investment income arising from the assets representing the explicit components of a solvency margin as part of the estimated annual surplus for the purpose of determining the future profits on an implicit item would result in double-counting. This is because if the assets were required to meet the effects of adverse developments, this would automatically result in the cessation of the contribution to profits from the associated investment income. Regulation 11 (4) already ensures that any contribution to surplus arising from transfers from the profit and loss account, including investment income on shareholders' assets, is not to be included in the estimated annual profit. However, double-counting could still arise in respect of investment income from the assets representing the explicit components of the solvency margin carried within the long term fund. Where there is reason to suspect that the elimination of such double-counting would reduce a company's solvency margin to close to or below the required level, the DTI will require further information with a view to taking account of this factor.

5.6 The average number of years remaining to run on policies should be calculated on the basis of the weighted average of the periods for individual contracts, using as weights the actuarial present value of the benefits payable under the contracts. This is now covered in Regulation 6 of the 1985 Regulations. A separate weighted average needs to be calculated for each of the categories of contract. Calculations will be required only for the main categories of business, accounting for not less than 90% of the mathematical reserves. Detailed calculations will not be required when a Section 68 Order is sought in respect of a lower multiple of the annual profits, well within the average term to run for the company.

One obvious problem with the estimation of future profits is that of lapses. Because of this, allowance must be made for the possible premature termination of contracts, based on the actual experience of the office over the preceding five years. This should take into account factors such as options which may lead to premature termination, guaranteed surrender values on income bonds, and option dates on flexible whole life contracts. Methods of calculation which involve a degree of approximation may be permitted.

Where there is uncertainty about the likely period to run, such as for pensions contracts with a range of retirement ages, the implicit item must be based on prudent assumptions tending, if anything, to underestimate the average period to run. The note includes an annex which gives definitions of the periods left to run for various types of contract. The definitions are generally those which would be dictated by commonsense, e.g., the expectation of life for whole life assurances, the period to the fixed maturity date for endowment contracts, and so on. For most kinds of group pension scheme, a period of ten years can be used.

5.7 The appointed actuary needs to enclose a certificate with his application for a Section 68 Order certifying that the amount sought by the company does not exceed the lower of the amount calculated in accordance with Regulation 11 (1981 Regulations) applied on the basis set out in the guidance note, and the present value of the profits that may be expected to accrue in the future on the long term business in force on the valuation date.

The assessment of future profits should be based on cautious assumptions with regard to future experience, except that the $7\frac{1}{2}\%$ contingency margin in the rate of interest is not required for this purpose. Credit may be taken on a prudent basis for margins in the future premiums payable under existing contracts, and also for future increases in equity dividends and rents.

5.8 The actuary also needs to certify that any application for an implicit item in respect of zillmerizing has been calculated in accordance with Regulation 12 of the 1981 Regulations. It should be noted that the implicit item in respect of zillmerizing is not permitted for term assurance or permanent health insurance. It will only be applicable in the case of linked contracts where a net premium method of valuation has been used. The guidance note mentions that some modification of the definition in Regulation 12 (4)(e) of the relevant capital sum for linked contracts is required, and this modification is in fact incorporated in Regulation 7 of the 1985 Regulations (See § 3.6 above).

6. FURTHER CLARIFICATION OF THE REGULATIONS FOR CALCULATING SOLVENCY MARGINS

6.1 Apart from the Act, Regulations and Guidance Note referred to above, clarification on a number of points concerning solvency margins has been made as experience has been gained in applying the rules. In a paper entitled 'Solvency Margins', presented to the Birmingham Actuarial Convention on 12 September 1985, Peter Hinton of the GAD described a number of these points.

6.2 The paper clarifies the meaning of Regulation 6 of the 1981 Regulations, which provides for a 4% solvency margin only 'insofar as an insurance company bears an investment risk'. The investment risk referred to is that inherent in the contract structure, rather than stemming from any other aspect of the financial management of the company. In other words, even if the company effectively reduces its investment risk to a negligible level by holding matching assets, if under the contract design it is possible for there to be an investment risk, the 4% solvency margin still applies. This is also true where there is an option such as a guaranteed annuity option rate. Even if the option is based on such conservative terms that the cost is negligible, the full 4% margin applies. The same is true of a deposit administration contract which guarantees a minimum interest rate of, say, 4% per annum, or to any contract where there is a guarantee of capital. The 1% or 0% solvency margin for linked business is intended merely to recognize the fact that under contracts where the benefit depends solely on the current value of the linked assets the investment risks are borne wholly by the policyholder and not by the company.

6.3 One further point of query has been the appropriate rate of solvency margin to apply to sterling reserves of linked contracts. A case could be made for applying the 4% solvency margin to sterling reserves in all cases, because the calculation of the reserves involves an assumption about the return on investments. However, in order to avoid anomalies where a 1% or 0% solvency margin applies to the unit reserves, it has been decided that the same rate of solvency margin should apply to associated sterling reserves.

6.4 The paper points out that the problems of meeting solvency margin requirements are likely to be greater for the newer, largely unit-linked offices than for the longer established offices. It reiterates that, provided the guarantee fund is met, the company which cannot meet its required solvency margin but can demonstrate (via a plan as described in Section 32(4) of the Insurance Companies Act 1982) that this will only be a temporary state of affairs may be permitted to continue to write new business.