INVESTMENT RISKS WORKING PARTY

1. TERMS OF REFERENCE

The terms of reference for this working party were to consider Investment Risks within the overall terms of reference for 3 working parties as follows:-

"An insurance company must maintain sufficient reserves and provisions to cover the following risks:

1. Technical Risks

1.1 The risk that actual claims and expenses may exceed, or investment income may be less than, that expected or implied by the premium rates charged. Such risks may arise through (i) the premium rates being adequate but subject to fluctuations arising from random factors, catastrophe and cyclical risks or the operation of the business and insurance cycles or (ii) the premium rates being inadequate through a misjudgement of trends.

1.2 The risk that the premiums and claim provisions may prove to be inadequate.

2. Investment Risks

2.1 The risk of depreciation in capital values, including the risk of current assets proving non-collectible.

2.2 The risk of losses arising from movements in exchange rates.

3. Other Risks

3.1 The risk of the reinsurance program proving inadequate, either through its technical aspects (e.g. level of retentions) or through the quality of its reinsurers.

3.2 Other miscellaneous risks, e.g. fraud.

There will be three working parties, each one concentrating on one of the above three categorisations. The position of reinsurers should be considered as well as direct insurers.

Bearing in mind the impact of inflation on all the risks described above, each working party should consider the steps which the management of the company should take to assess the magnitude of each risk and the reserve which should be maintained to cover such risks, either singly or in combination.

It would be for subsequent consideration as to how the company should consider whether the actual reserves are sufficient to cover all the above risks, bearing in mind the need to avoid building margin upon margin."

The members of the working party were:

Andrew Thomson	Chairman
Susan Cooper	
David Craighead	
Russell Devitt	
Stewart Hartley	
Roger Harvey	
David Williams	

In reading this report, it must be clearly understood that the views expressed are solely those of the members of the working party (not necessarily unanimous) and are intended as a basis for discussion by the General Insurance Study Group.

2. BASIC PREMISES

The solvency margin of an insurance company is the difference between the assets and the liabilities (excluding shareholders' interests). Clearly, the size of the solvency margin will be directly related to the values placed on the assets and liabilities. The working party have been concerned only with the former.

If the value placed on the assets is excessive then there is the danger that the solvency margin stated in the annual return to the supervisory authority may not exist at all. The first line of defence must be therefore to ensure that assets are valued on a reasonable basis which is:

a) An accurate guide to the value the assets will provide if disposed of.

b) Can be readily checked by an independent person, such as the auditor.

Requirement (a) leads to the use of market values as the highest reasonable basis that may be adopted; there is, of course, no reason why a company should not adopt a more stringent basis.

In the case of stock market investments, published lists are available from which values may be checked. For property investments, a valuation has to be obtained from a professional surveyor. Such a valuation is an opinion based on that surveyor's interpretation of the market place - clearly at a time when the property market is very quiet with few transactions taking place the more difficult it is for the surveyor to arrive at his opinion.

For other types of assets such as debts, unquoted securities, etc. it is more difficult to meet the above criteria.

It is necessary, therefore, that the supervisory authority lays down some rules on how assets are to be valued or else little meaning can be attached to the solvency margin of any company.

Within the UK, the Department of Trade have done just this.

Having established a satisfactory solvency position in the return just submitted to the supervisory authority relating to a date some months in the past, attention needs to be focused on the dynamic position both now and in the future. As far as the assets are concerned consideration has to be given to the variation in asset values that have already occurred and will occur in the future.

Our starting point was the proposition that a position of negligible risk and so for all practical purposes no risk exists if all investments are in the form of first class bank deposits in appropriate currencies. By appropriate currencies, it is intended that technical liabilities are at least matched by currency.

Research was then carried out to attempt to measure the risks involved in departing from such a no risk position either in the form of investment medium or by mismatching of currency. Also, the question of current assets turning out to be bad debts was considered.

3. MEASURE OF RISK OF INVESTMENTS

As a first step, we decided to look at the variation in values of various forms of investment. We had long discussions as to over how long a period the variation in values of investments should be considered. There were basically two views put forward.

One view was that the period should be related to the run-off pattern of the technical liabilities, outstanding claims and unearned premiums, and would thus consider notional realisations spread over a number of years. The shape and timescale of this would depend upon the characteristics of the technical liabilities of each individual company.

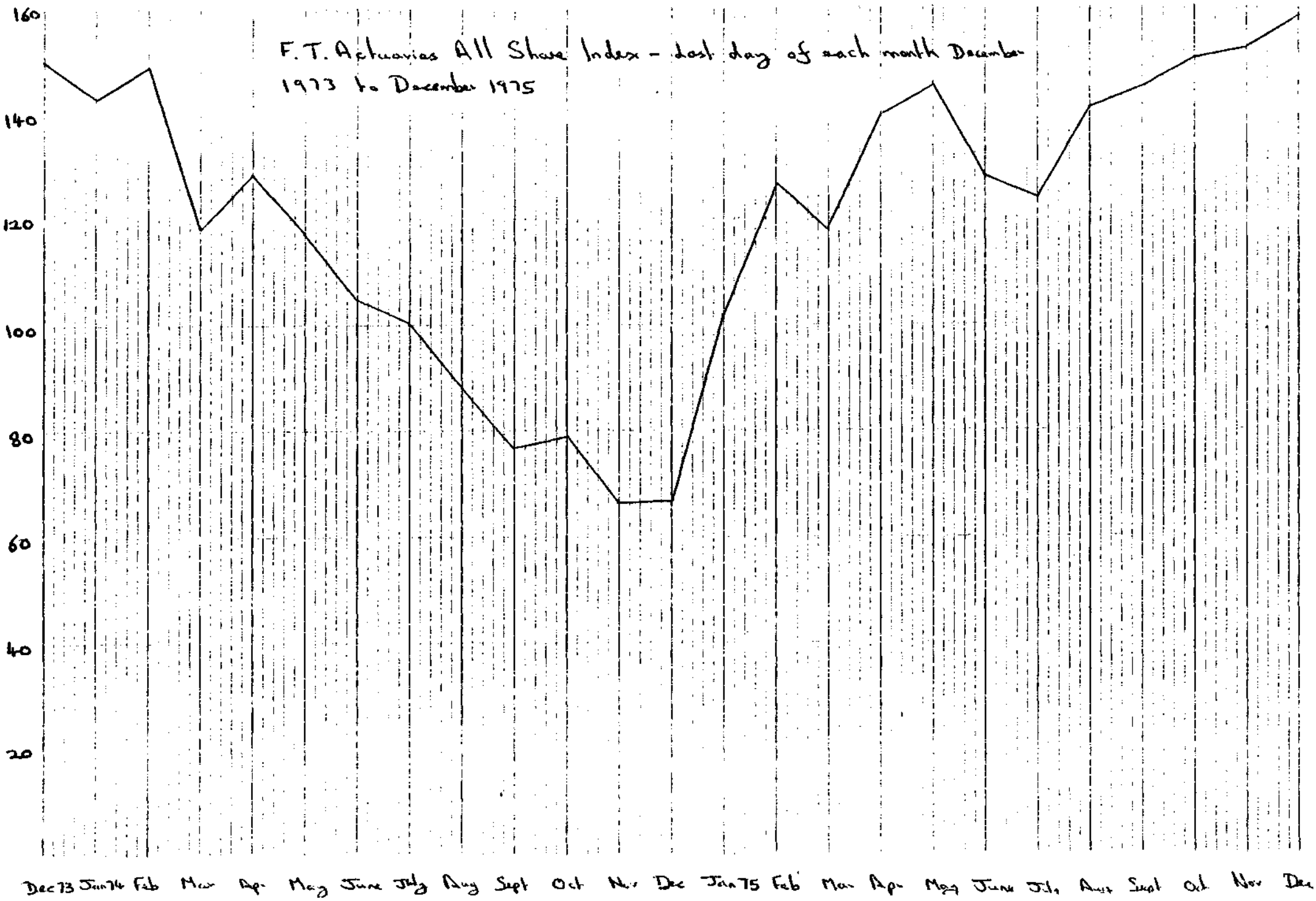
The alternative view was that a fairly short timescale was the more appropriate since a supervisory authority normally receives returns annually from the insurance companies for which it is responsible. Allowing for the time delay between the end of a company's financial year and submission of its returns to the supervisory authority and the subsequent examination of the returns, the variation in investment values should be considered over periods of 1 year and 2 years. For illustrative purposes, the latter approach was adopted.

Various forms of UK investments were considered over the 20 year period 1960 to 1980 and the results are set out in Tables 1-6. In Tables 7 and 8, the movements in currencies (sterling against the US dollar and the German mark) over the same period are considered without taking account of the results of investing in the stock markets (or even putting money on deposit) of these countries.Comments on these tables are:-

a) We had considerable discussion over whether capital values only should be considered or whether investment income at the level appropriate to the particular form of investment should also be included on the assumption that it has not already been requisitioned in the technical reserves (for example, by discounting claims explicitly or implicitly by assuming a low rate of inflation). On the other hand, even in our postulated ideal position, interest would be earned on monies on deposit.

   In the event, investment income has not been considered which is of greater importance to gilts than to equities because of the reverse yield gap.

b) In retrospect, the period chosen and the use of year end values has probably increased the variability of equities and gilts. The massive and steep market fall of 1974 bottomed out virtually at the end of 1974 and was followed by an equally rapid rise during 1975. This is demonstrated by the following chart showing the level of the F.T. All Share Index at the end of each month during those two years.


F.T. Actuaries All Share Index - last day of each month December 1973 to December 1975
160
140
120
100
80
60
40
20
Dec 73
Jan 74
Feb
Mar
Apr
May
June
July
Aug
Sept
Oct
Nov
Dec
Jan 75
Feb
Mar
Apr
May
June
July
Aug
Sept
Oct
Nov
Dec

c) Throughout the last 20 years, there has been a trend of rising interest rates and hence falling capital values of gilts. Within this trend, there have been sharp short-term rises and falls leading to volatile capital values of fixed interest stocks and this is demonstrated in the tables. However, the variation in gilt capital values is, as might be expected, much less than that of equities.

The United States practice of amortization gives more stable values, which can however be in excess of market values. This would be no problem if the term of these assets was matched to that of the liabilities but this is probably not the case.

d) Although Property looks the best form of investment over the period chosen and particularly during the bear market of 1973/4, it is not always possible to sell a property at its full "stated market value" if one is forced to dispose of it in a hurry. This is, of course, especially true if there are others in a similar predicament at the same time.

It is doubtful if the indices used for Property (Table 6) accurately reflect how much a forced seller would actually have received at the end of 1974.

e) In Table 7 it may be seen that until 1971, there was scarcely any movement in sterling against the US dollar except for a sharp fall in 1967. The reason for this is simple. Until 1971, fixed exchange rates were maintained but in 1971 this was generally changed to floating exchange rates. The sharp movement in 1967 was the devaluation of sterling. Table 8 shows similar features with the addition of a sharp movement in 1969 which was caused by revaluation of the D-mark. Whatever useful information may be gleaned from the type of analyses in Tables 1 to 6 on likely variation in investment values, it is very doubtful if Tables 7 and 8 say anything useful other than that movements between currencies of even the major western countries are very volatile indeed. Strict matching of assets and liabilities by currency is considered essential if the risk of substantial currency losses is to be avoided.

f) It is obviously a matter of opinion as to whether or not the period chosen is any guide to the next 20 years.

However, we did not feel that looking at the variability within indices went far enough into the problem. It is unlikely that a company would be invested exactly in line with an index.

It is fairly obvious that the more narrow based a portfolio, the greater the variability. This is examined in more detail in the following section.

4 DIVERSIFICATION OF INVESTMENT PORTFOLIOS

A general insurance company will typically be invested in a range of assets - fixed interest (including gilt-edge stocks), equities, property, mortgages and loans and deposits. Examples are shown in Table 9 which illustrate a bias towards fixed interest investments but also a considerable presence in equities and also, for some companies, in property. Within these categories, there will be a spread of individual investments each exhibiting a variability in its return. For fixed interest securities (whether corporate or British Government) the main source of variability is, obviously, movements in interest rates. Diversification of a fixed interest portfolio will clearly not reduce significantly the variability of the total portfolio as price movements of the stocks are highly correlated with each other. The only real diversification that can be achieved is by investing in stocks with different maturity dates and coupons i.e. with different average lives. For corporate fixed interest stocks and for mortgages and loans the risk of default can be reduced by diversification, although there will be some correlation between stocks in this respect, given that, for example, economic factors that may precipitate default will be common to many companies.

For equities (and for property investments) portfolio diversification is a much more significant factor in reducing the variability of the return, commonly called reducing the risk in an investment. The principles are best explained by considering a portfolio of two items. This could be, in general, gilts and equities or U.K. equities and overseas equities or just two shares. The variance of the return of the portfolio is given by

$$s^2 = a^2\sigma_a^2 + b^2\sigma_b^2 + 2ab\rho\,\sigma_a\sigma_b$$

where: a is the porportion invested in say share A and b = 1-a
σ_a and σ_b are the standard deviations of the return on shares A and B respectively
ρ is the correlation coefficient between the returns of shares A and B.

A numerical example can help to explain this:

Suppose $\sigma_a = \sigma_b = .25$

and $a = b = \frac{1}{2}$

Then $s^2 = (\frac{1}{2})^2 \times (.25)^2 + (\frac{1}{2})^2 \times (.25)^2 + \frac{1}{2}\rho\,(.25)^2 = \frac{1}{2}\,(1+\rho)\,(.25)^2$

If $\rho = \frac{1}{2}$ (which is a typical figure for two equities)

$s^2 = .75\,(.25)^2$

i.e. s = 0.22 - representing a reduction of 12% in the variability

If $\rho = \frac{1}{4}$ (which may be typical for the correlation between U.K. equities and Japanese equities) and $\sigma_a = \sigma_b = .20$ (markets have less variability than individual shares)

$s^2 = .625\,(.20)^2$

i.e. s = 0.16 - a reduction of 20% in the risk

When one looks at a portfolio of n shares, the problem becomes intractable because one requires ρ for each pair of stocks. Modern Portfolio Theory resolved this difficulty by introducing β, i.e. the correlation of an individual share with a stock market index.

The diversification of the risk by holding a portfolio can then be expressed in the following graph. This breaks down the total risk involved in holding equities into two elements.

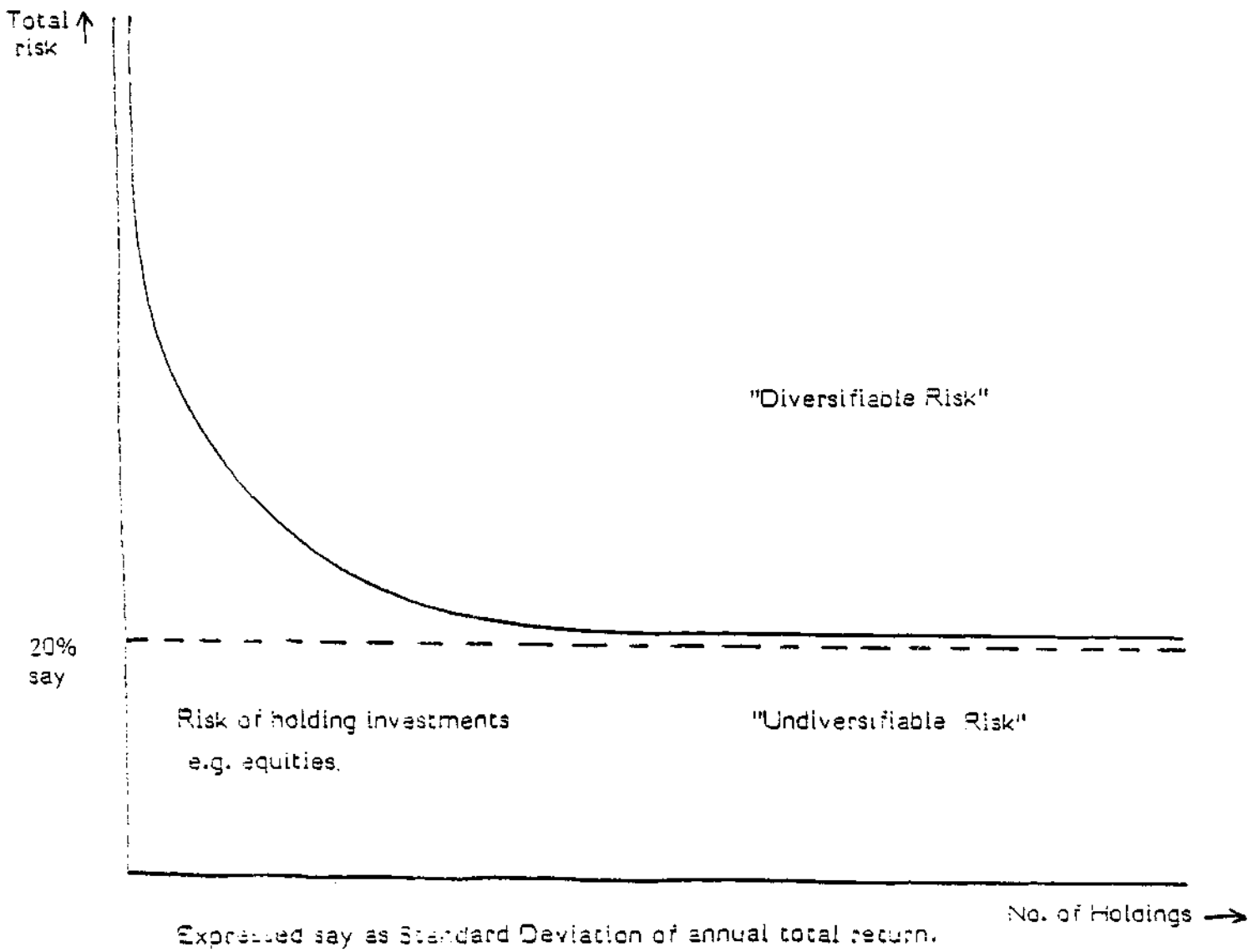
(i) the undiversifiable risk involved in holding equities

(ii) the risk involved in holding an individual equity, which may be reduced by holding a portfolio of shares.

If σ (the standard deviation of the return on a share) = 0.25, which is about right for large companies, then the residual specific risk of a portfolio of n shares (equally invested) is $\frac{0.25}{\sqrt{n}}$

n	residual risk
1	.250
2	.177
3	.144
4	.125
5	.112
10	.079
50	.035
100	.025
1000	.008

The graph then looks as follows:



As a broad statement, the implication for a general insurance company is that diversification of a portfolio of equity shares (or property investments) can reduce the risks involved in holding these categories of investment and therefore can reduce the margin of free reserves held against the risk of an unfavourable return from those investments. To the extent that the returns on the individual investments are not correlated with each other, then the risk (and the consequent solvency margin requirement) is further reduced.

The argument then becomes that, in assessing the adequacy of free reserves, it is important to consider not just the extent but also the nature of the diversification of an investment portfolio.

5. THEORETICAL APPROACH

In section 3, we had a look at the sort of variation in values that has occurred for various types of UK investments by reference to indices.

In section 4, we demonstrated that an individual portfolio is likely to experience greater variability than a wide-based index. We now come to the crux of the problem, which is how we determine the value in the future of an individual portfolio.

The problem of the supervisory authorities stems from the fact that when they receive a company's returns the value of the investments in the company's portfolio has already changed, and it will be different again by the time the following years' accounts are submitted. It is because of this fluctuation that it is necessary for a company to hold a margin.

Since the need for the margin arises from the variability of investment values, there would seem to be a good case for determining the margin to be held by reference to that variability. However, it must be made clear at the outset that this variability is different from that of, say, estimates of outstanding claims. The values of investments at the balance sheet date are a matter of fact, but they can assume different values at different points of time. Outstanding claims estimates, on the other hand, may change in value over time, but this is because the funnel of doubt has reduced, as it will tend to do until it disappears on settlement, that is when the value of the claim becomes definite.

The supervisor may perhaps be regarded as treating the values of the investments which appear in the balance sheet as an estimate of their future value. The variability with which he is concerned is therefore the difference between the value shown in the returns and the value when the next set of returns is prepared.

At this point, a fundamental decision has to be made. Are we concerned with the value of the portfolio at the end of the year, or are we concerned with the value throughout the year? Connected with this is the question of changes in the portfolio after the year end. For the sake of simiplicity, we have assumed in what follows that restructing ourselves to year end values is sufficient, but this is a matter which requires further investigation.

To adopt this approach, it is necessary to develop some sort of model of investment values, which can be used to measure variability and hence determine the required margin. This will require data relating to the previous years from which the behaviour of the investment values can be inferred.

Suppose that such data is available, and let V_t be the value of the investments for year t. Then we wish to find some function f(.) such that

$$V_{t+1} = f(V_t, V_{t-1}, \cdots) + e_t \qquad (1)$$

where f(.) relates in some way the expected value at time (t + 1) to the observed past values. This function may contain parameters which will need estimation from past data.

The error term e_t is assumed to be an independent, normally distributed random variable with zero mean and variance σ^2. Because we know, or can estimate, this variance, we are able to make probability statements about our estimates. The degree of variability in the estimates, and hence our confidence in them, will be reflected in the width of the confidence interval; that is to say, it will be a function of σ.

Probably the simplest model is obtained by assuming that the expected value of the V's is constant, that is, each V is the realisation of an event randomly sampled from the same distribution. This model would be

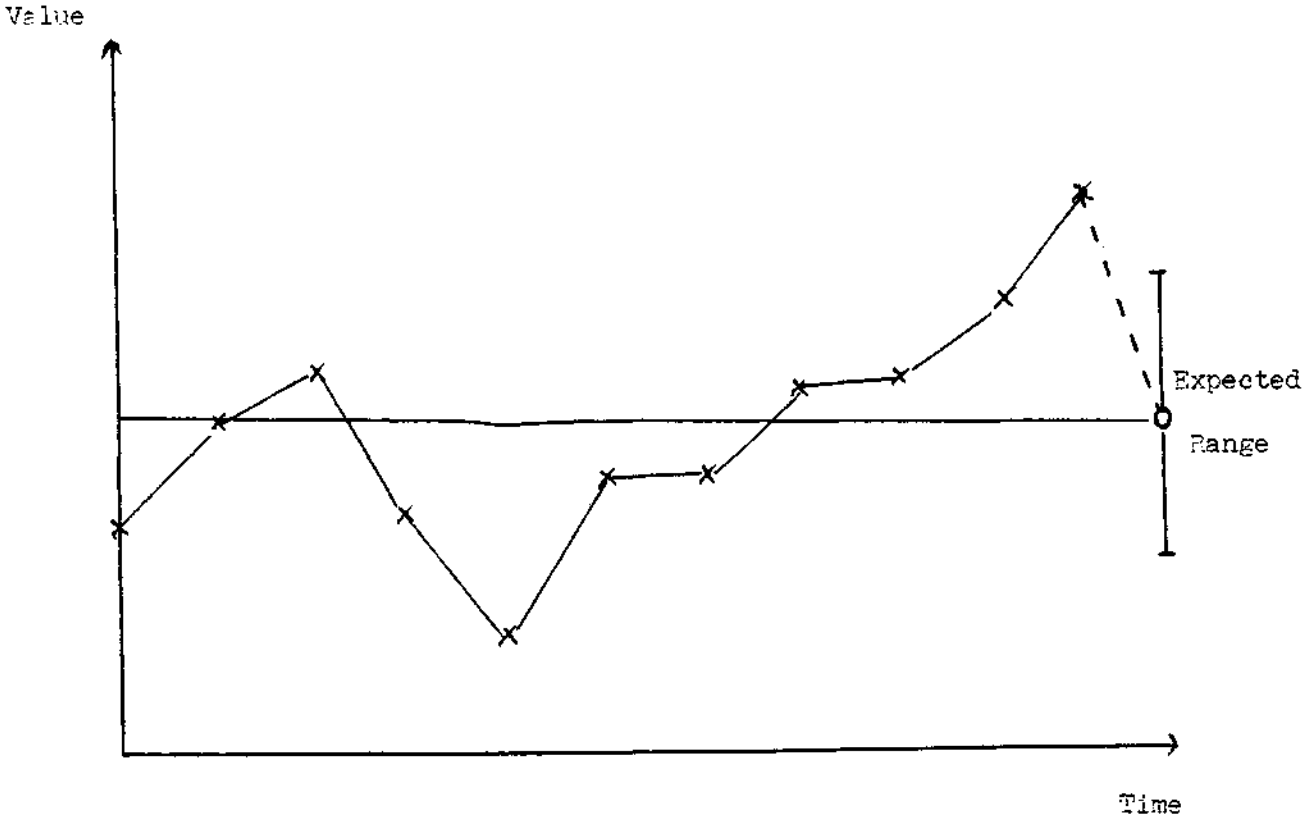
$$V_{t+1} = \mu + e_t \qquad (2)$$

where μ could be estimated by

$$\mu = 1/t \sum_{i=1}^{t} V_i$$

i.e. the mean of the previous V_i.

This model is illustrated in the following diagram.

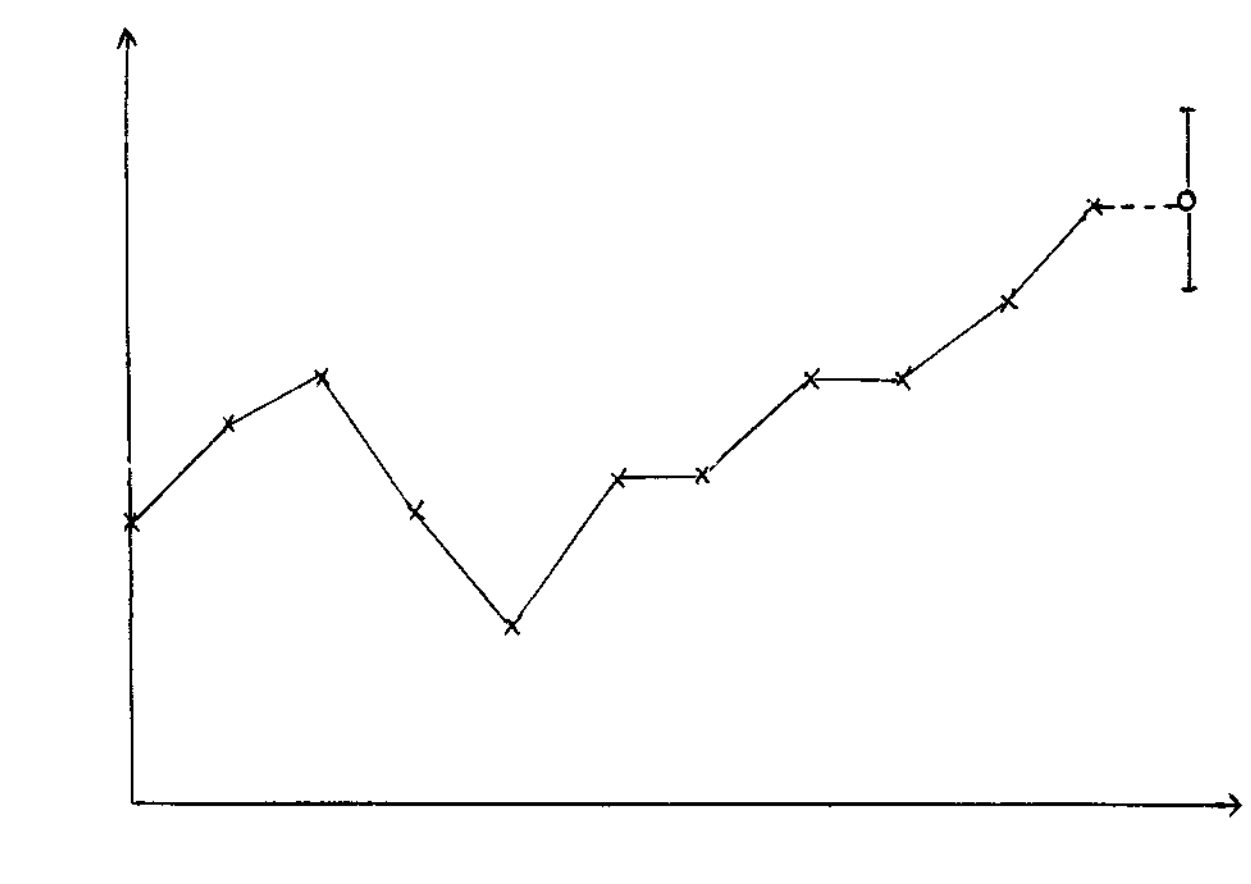


It could be argued that this model would be improved if the value of V_{t+1} depended upon V_t alone, instead of the mean of all the V's.

This suggest a 'Simple Random Walk' model, ie one of the form

$$V_{t+1} = V_t + e_t \qquad (3)$$

This model is illustrated as follows:

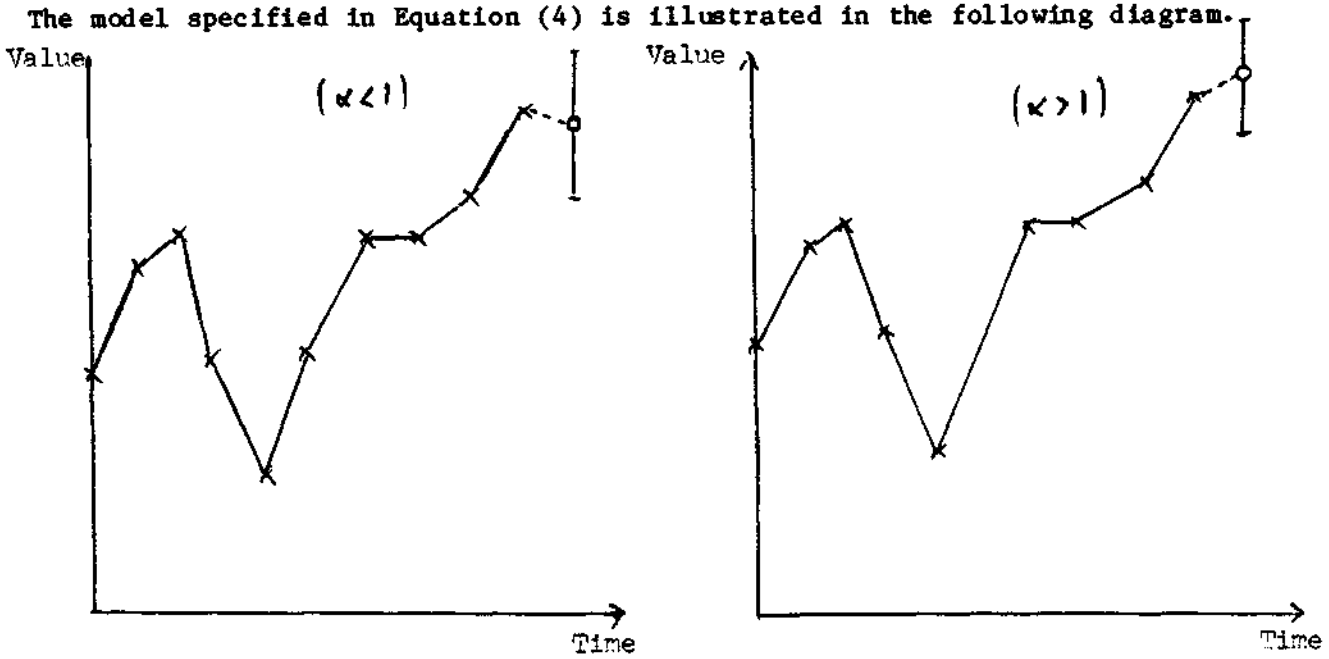


However, it would be necessary for successive V's to be relatively close to each other if the error terms are to be reasonably small. This may well not be the case, but this can be allowed for by introducing a suitable constant α, by which V_t can be scaled up or down. This gives an auto-regressive model, as described by Box and Jenkins (1) of the form

$$V_{t+1} = \alpha V_t + e_t \qquad (4)$$

Where $\alpha < 1$, this will produce a stationary time series. If $\alpha > 1$, the time series will constantly increase. Equation (3) above is the special case of (4) where $\alpha = 1$.

The model specified in Equation (4) is illustrated in the following diagram.



Further refinement can be effected by arriving at an appropriate series of α's, one relating to each V. The model thus becomes

$$V_{t+1} = \sum_{i=1}^{t} \alpha_i \, V_{(t+1)-i} + e_t \qquad (5)$$

which is, in fact, the weighted average of the past data. One common example of this type of model is to set $\alpha_i = \alpha^i$, to arrive at an exponentially weighted time series. Another is to set $\alpha_i = 1/p$, which gives an average of the previous p observations.

Equation (5) is known as an autoregressive model of order t. Equation (4) is an autoregressive model of order 1. In general, we define an autoregressive model of order r to be

$$V_{t+1} = \sum_{i=1}^{r} \alpha_i \, V_{(t+1-i)} + e_t \qquad (6)$$

An alternative modification is to look at the deviations from the mean of the V's, and use these to construct the model.

In this case we have a model of the form

$$W_{t+1} = W_t + e_t \qquad (7)$$

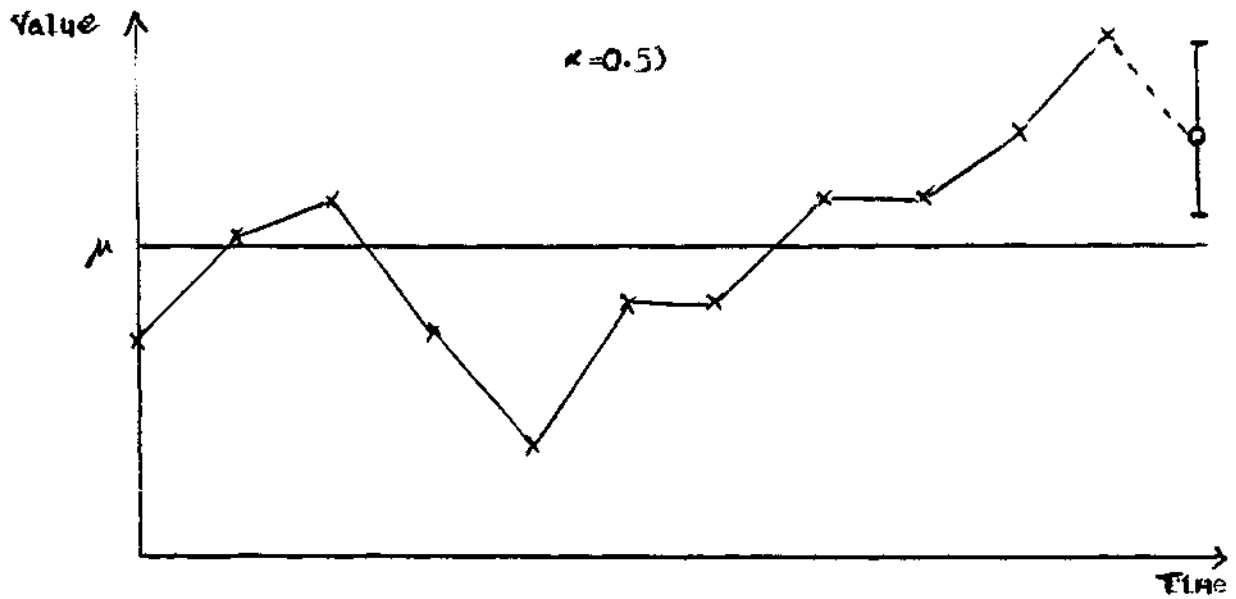
where $W_t = (V_t - \mu)$

We can reformulate this to arrive at the following:

$$V_{t+1} = \mu(1 - \alpha) + \alpha V_t + e_t \qquad (8)$$

This can be regarded as the weighted average of the mean and the latest observed value. As such, it is a combination of (2) and (3) above. The weight α used here is similar to the credibility factor employed in credibility theory - see for example Norberg (2).

The model in Equation (8) can be illustrated as follows



The form of this model is very similar to the model developed by the Maturity Guarantees Working Party. This is not altogether surprising, since they were working on essentially the same problem, though over a much longer timescale.

Having outlined the theory of the model, it is necessary to look at its practical application. First of all, some form of measurement of investment values is required. Traditionally, indices have been used for this purpose. However, in this application, there is the problem that an index, particularly a widely based one, will probably exhibit less variability than the portfolio of an individual company. Theoretically, securities should be looked at individually but this may not be a practical proposition. Perhaps the answer is to use some intermediate grouping such as industries or sectors.

Apart from the level of detail to be used, there are other practical problems to be faced, such as how are unlisted securities to be dealt with, what to do with new securities where there is no historical data on which to base an estimate of variability, and how to cope with assets for which no index is available, such as loans and mortgages, especially how to allow for the lack of marketability. It is not possible to explore these problems in this note, but the models outlined above assume that adequate details of the past performance of all the investments in the company's portfolio are available.

The model outlined above can be used to arrive at valuations for each investment held, but when we come to arrive at the total value of the investment portfolio we encounter a problem. Because our model is stochastic, the valuations arrived at are not point estimates but distributions of random variables. The combination of the distributions for each investment of a particular class, and of each class in total, gives a new distribution, with new characteristics and new parameters. It is not possible, therefore merely to aggregate the distributions that have been arrived at. It will be necessary to convolute the distributions, which may not be an easy task to perform, though the assumption of normality in the error terms does make matters a bit easier in this respect. Nevertheless it will certainly require considerable computation if the portfolio is of any size.

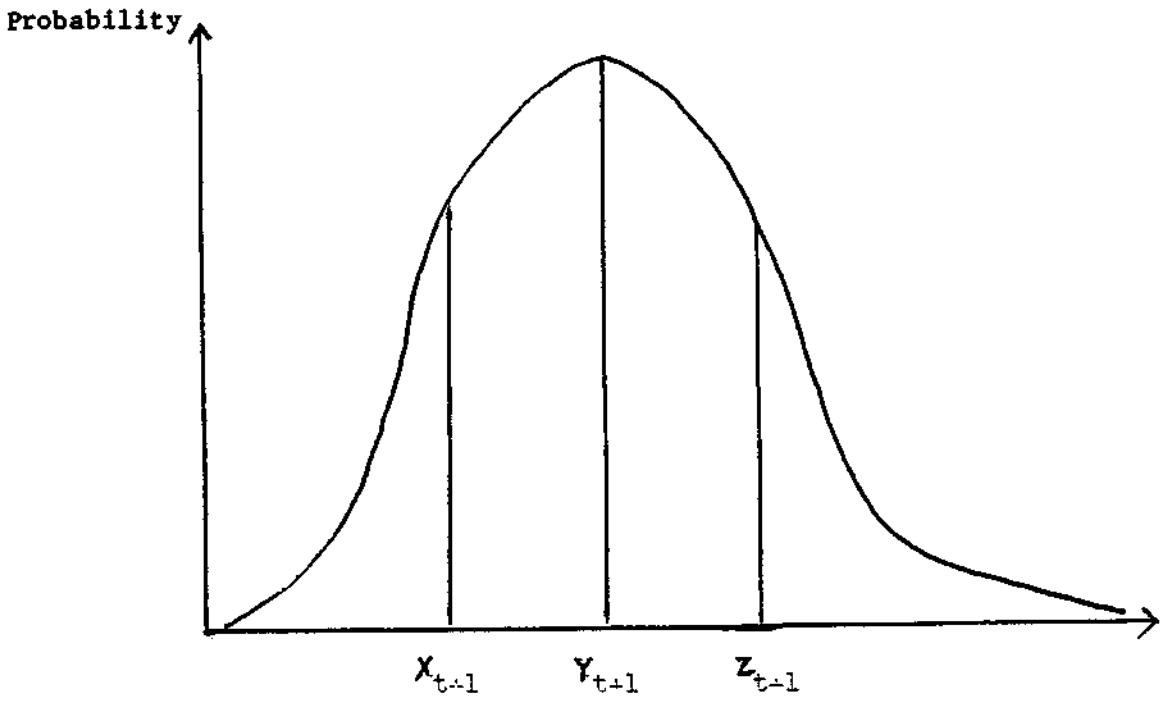
Again assuming this problem can be overcome, we return to the problem of the margin to be held against fluctuations in the value of investments. Using the distribution constructed from our convolutions, we can make the probability statement that, for a given level of confidence P,

$$X_{t+1} < V_{t+1} < Z_{t+1}$$

$$\text{and} \quad E(V_{t+1}) = Y_{t+1}$$

where X_{t+1} is the lower confidence level for the estimate of V_{t+1}
Y_{t+1} is the expected value of V_{t+1}
Z_{t+1} is the higher confidence limit of the estimate of V_{t+1}

This is illustrated below:-



We can now fix the margin to be held by reference to X_{t+1}, the lower confidence level of the estimate of the values of the investments. In this way, the margin will take account of the characteristics of the individual company's investments.

In order to outline the method employed, it has been necessary to make certain assumptions which may be impracticable or may not hold. These require further investigation. In addition, there is the very real problem that the use of such methods demands that companies have access to a level of expertise that may not be available. An answer would have to be found to this, since it would be smaller companies that would tend to have this problem, and it is these very companies whose portfolio are likely to exhibit variability, and hence require a margin.

6. CURRENT ASSETS

The conventional definition of current assets would be 'cash, bank balances and other resources that are reasonably expected to be realised or consumed within one year from the date of the balance sheet' (3) However, this is not necessarily appropriate to insurance companies, at least for the purposes of this note. We have discussed above the treatment of risk in the valuation of investments; we are concerned therefore with those assets which do not fall under the heading of investments. Using the classification of assets prescribed by the appropriate regulations for DOT returns, this would seem to indicate the follow:

(a) Local authority and Building Society deposits and bank deposits and current accounts

(b) Tax recoveries due from tax authorities

(c) Insurance debts

(d) Other debts

(e) Cash

(f) Other assets, principally computer and other office equipment.

Cash deposits and current accounts

The Accounts and Forms Regulations require a distinction to be made between current accounts and deposits repayable within twelve months on the one hand, and deposits repayable in more than twelve months on the other. The Valuation Regulations require the former to be valued at par, while the latter have to be included at their current market valuation.

This corresponds well with the point of view expressed above that the supervisory authorities are interested in the balance sheet as an estimate of the solvency of the company in a year's time. For those accounts where the cash is repayable in that period, the valuation is, in effect, the amount that will be repaid. For those accounts not repayable in that period, the treatment is the same as for investments. The approach outlined in the section on investments would appear to be appropriate here also.

As far as those accounts which are not being treated as investments are concenred, i.e. those repayable within 12 months, the risk of default is presumably negligble, or in the rare cases where this is not true will have been provided for in accordance with the concept of prudence described in SSAP2 (4). The only risk that needs to be taken account is therefore, provision is required only for the currency risk, dealt with below.

Tax recoveries

It is to be presumed that debts due from the tax authorities do not involve any risk of default. Again, therefore, provision is required only for the currency risk, dealt with below.

Insurance debts

The Regulations require insurance debts to be analysed between

(a) those due in respect of direct and facultative business

(b) those due in respect of outward reinsurance

(c) those due in respect of inward reinsurance.

Our terms of reference included specific mention of bad debts, and consequently we have spent some time on this problem. However, we have been severely hampered by the lack of published information available.

The only office which we were able to discover which made specific mention of a provision for bad and doubtful debts was the Norwich Union! Details of the amounts concerned are:

Year	£000	% of premium income
1977	276	0.1
1978	499	0.2
1979	656	0.2

It can be seen that the amounts involved are relatively trivial, and this experience was confirmed by such enquiries as memebers of the Working Party were able to make. This was true whether the offices were broker orientated, and the debts were due from third parties, or home service offices, where the debts were due from ex employees.

It was decided that, in view of the lack of information that was available, the only useful analysis that could be performed was on the collection of debts.

A ratio sometimes employed in the analysis of accounts is the 'Debtors Turnover' or 'Average Collection Period'. It purports to show the average length of time (in days) a company takes to collect its debts, and is calculated as follows:

$$ACP = \frac{\text{Debtors}}{\text{Sales}} \times 365$$

In this form, the ratio is not directly applicable to insurance companies. However, if we substitute 'Amounts due from agents and intermediaries' for debtors and 'premium income' for sales, we should be able to get some idea of the average time it takes a company to collect premiums.

A sample of ten insurance companies was selected. Using their Department of Trade Returns, the amount of 'Insurance debts, being premium income in respect of direct insurance and facultative reinsurance contracts accepted not yet paid to the company by policyholders and intermediaries' was picked up.

The problem then arose that the premium income shown in the General Branch Revenue Account of the Return is net of reinsurance, whereas the debts referred to in the previous paragraph are in fact gross. The solution arrived at was to refer to the General Branch Premium Analysis, and to pick up from there the aggregate of gross premiums in respect of UK direct and facultative business and overseas direct and facultative business.

The Average Collection Periods were then calculated and are shown in the following table:

	Average Collection Periods (days)		
	1977	1978	1979
Commercial Union	90	93	90
Co-operative	21	24	24
Eagle Star	90	92	93
General Accident	77	66	69
Guardian Royal Exchange	88	89	92
Legal and General	*	78	70
Norwich Union	94	95	92
Prudential	48	44	48
Royal	73	84	83
Sun Alliance	85	83	86
TOTAL	79	79	79

*Not available

It can be seen that, although the individual companies ratios exhibited some variation, this was not so with the total figure. It is also worthy of note that the industrial offices generally had lower figures than the others.

It is clear that the risk inherent in the valuation of debts depends upon the individual circumstances of each company, unlike assets such as investments which are governed by general market forces. Thus, it is not possible to prescribe a method of determining of a margin, as was done for investments. All that can be done is to state that the concept of prudence and the operatic of the Regulations, which provide that no asset may be ascribed a valuation which is greater than its actual value, should ensure that no debt is over-valued.

This will apply not only to insurance and reinsurance debts, but to any other debts which appear in the balance sheet.

With reinsurance debts in particular, there is a further risk which cannot be ignored. This risk is concerned with the fact that, although the risk of one debtor defaulting in isolation is very small, the risk of many debtors defaulting simultaneously, perhaps because of a catastrophe, is possibly somewhat greater. We are not able to offer a means of assessing this risk, but feel it important that its existence is acknowledged.

There is also the question of the currency risk, which is dealt with below.

Cash

Cash in this context means coins and notes of the realm. There would not appear to be any risk that this asset will not realise its book value.

Other assets

The principal assets in this category are computer and other office equipment In the balance sheet of any other company, these would be regarded as fixed assets, and consequently subject to depriciation. As such, they would be subject to the provisions of SSAP12 (5) which states that 'Provision of depreciation of fixed assets having a finite useful life should be made by allocating the cost ..... less estimated residual values of the assets as fairly as possible to the periods expected to benefit from their use.'

The accounts prepared for the Department of Trade returns of an insurance company differ from those of the Companies Acts' accounts of other companies in that the former are prepared, broadly, on a 'break-up' basis, whereas the latter are on a 'going concern' basis. The insurance company must therefore take account of the possibility of not being able to realise the balance sheet value of the assets. This is done in the following ways:

(a) Much of the capital expenditure which could be capitalised is in fact charged to revenue in the year of purchase, and the assets are not therefore depreciated.

(b) The rates of depreciation effectively presented by the Regulations - 25% for computer equipment, 50% for other office equipment - are fairly conservative.

(c) No account is taken of any possible residual value.

Given this conservative approach, and the over-riding provision in the Valuation Regulations that where the value of an asset is less than that prescribed in the Regulations the lower amount should be used, it would appear that adequate provision is made for the risk of loss on this type of asset.

Currency Risk

Many of the assets dealt with in this section may consist partly or wholly, of currency balances. Provision is necessary for the currency risk, ie the risk that, all other things being equal, the asset will be worth less in a year's time merely because of movements in exchange rates.

This section describes a possible method for making such provision, using the same approach as that advocated in the section on investments above. It will be recalled that it was proposed that there should be employed a model of the form

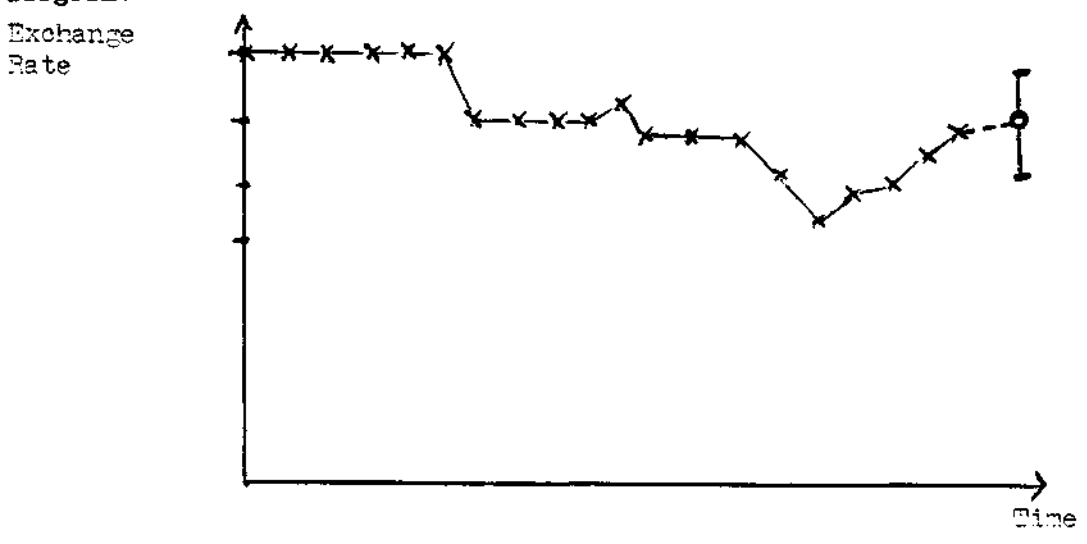
$$V_{t+1} = \mu(1 - \alpha) + \alpha V_t + e_t$$

By way of an example, the exchange rates for the US dollar, set out in Appendix were used. The model derived gave approximately

$$\mu = 2.41$$

$$\alpha = 0.8$$

The error term had a standard deviation of about 0.06. Then, since we are assuming that the error term e has a normal distribution, we can assert that at, say, a 97½% level of confidence, that dollars worth £100 now will not be worth less than £89 in a years time. This is illustrated in the following diagram:



There are a number of possible objections to the above approach. Firstly, the model may not be regarded as the appropriate one. Secondly, the past data used to devise the model covers periods of both fixed and floating exchange rates. Nevertheless, these objections are capable of being overcome, and the principles underlying the method are, we believe, sound.

If an office holds currency assets, it is likely also to hold currency liabilities. If a positive margin is required to be held against the possible variation of currency values of these assets, as measured above, then it follows that a negative margin would be required for the liabilities denominated in that currency. It would seem, therefore that the logical approach would be for an office to determine its total assets and liabilities in a particular currency, and then provide the appropriate margin, determined as above, against the net amount.

Summary

There are two risks with which we are concerned when looking at current assets: firstly the risk that the assets will not realise their book value, and secondly, the currency risk.

As far as those assets which would be classed as fixed assets in the balance sheets of other companies are concerned, it appears that the provisions of the Regulations are stringent enough to provide for this risk. The remainder of the current assets consist of various balances due from banks, agents, policyholders etc, where provision must be made for possible default.

For currency risk, it is possible to adapt the method outlined in the section on investments. In this way, the margin required for all assets less liabilities denominated in a particular currency can be determined.

In general, it must be remembered that the fundamental accounting concept of prudence requires that provision is made for all known losses, whether the amount of these is known with certainty, or is a best estimate in the light of the information available. In addition, the Valuation Regulations provide that where a valuation is prescribed for an asset, but that it appears that the time value is less than this amount, then the lowere amount shall be used. Taken together, these two stipulations should ensure that current assets are not over-valued.

7. HOW DO INSURANCE COMPANIES INVEST

We thought it would be of interest to see how insurance companies invest their assets, in practice.
Table 9 shows the breakdown of total assets for 23 companies of greatly differing sizes based on their 1979 Department of Trade Returns.
It will be seen that many companies, particularly amongst the large companies, have dependent companies, both insurance and other,which are not consolidated in their DOT Returns accounting for a substantial part of their assets. These dependent companies many of which are overseas will have their own distribution of assets and the values shown represent their free reserves excluding the statutory solvency margin calculated in accordance with UK legislation.

It will be seen that some small companies are very heavily invested in equities. It is here that Section 4 on the diversification of portfolios is particularly relevant as a smaller company is unlikely to achieve the same spread as a larger company with a similar proportion of its assets invested in equities. On the other hand there is one small company (No. 21) with no equity investments at all - its ratio of free reserves to solvency margin is one of the lowest at 1.5. In fact the range of this ratio is from 0.6 to 7.3.

8. CONCLUSIONS

If nothing else, we hope that this report demonstrates that investment risks can be very considerable and that the degree of risk is individual to each company as it is dependent upon the precise assets of each company.

Consequently, we also feel that when a supervisory authority considers the financial position of an insurance company some regard must be had to the likely potential variation in the value of the assets. We would put forward that the statutory solvency margin should contain an element representing this potential variation and that it should be calculated by reference to the individual company's assets rather than by a simple general formula such as a proportion of written premiums or even total assets.

Either the type of method in Section 5 may be used although we have to accept that there are considerable practical difficulties involved or some simplified approach such as taking margins on individual categories of assets. Either way, it would be necessary to avoid building margin upon margin and to take account of matching assets and liabilities by currency. There is still a tremendous amount of work in either approach to be carried out before it could become a practical approach to be universally adopted.

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3. International Accounting Standards Committee (1978) 'Current Assets and Current Liabilities' International Exposure Draft 14.

4. Accounting Standards Committee (1971) 'Disclosure of Accounting Policies' Statement of Standard Accounting Practice No 2.

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TABLE 1

EQUITIES

The figures below are the amount that £100 invested on December 31 will produce 1 year and 2 years later.

YEAR	After 1 year	After 2 years
1960	97.52	101.62
1961	104.19	120.06
1962	115.23	103.70
1963	89.99	95.23
1964	105.82	96.02
1965	90.74	116.78
1966	128.70	184.60
1967	143.43	121.64
1968	84.80	78.47
1969	92.53	131.30
1970	141.88	160.08
1971	112.83	77.45
1972	68.65	30.66
1973	44.66	105.54
1974	236.35	227.22
1975	96.14	135.67
1976	141.12	144.86
1977	102.66	107.14
1978	104.36	132.70
1979	127.16	
Standard deviation	38.31	42.24

Notes F.T Actuaries All-Share Index 1962-1980
1960 and 1961 are approximations from the Actuaries Investment Index (Industrial Equities)

TABLE 2

GILTS

The figures below are the amount that £100 invested on December 31 will produce 1 year and 2 years later.

YEAR	After 1 year	After 2 years
1960	86.27	102.38
1961	118.67	115.59
1962	97.41	88.29
1963	90.65	88.53
1964	97.68	96.36
1965	98.65	94.09
1966	95.37	84.98
1967	89.09	82.71
1968	92.83	86.90
1969	93.61	116.90
1970	124.89	103.55
1971	82.92	65.72
1972	79.26	53.43
1973	67.42	81.97
1974	121.60	119.27
1975	98.10	131.72
1976	134.26	115.94
1977	86.36	79.78
1978	92.38	98.33
1979	106.44	
Standard deviation	16.38	19.45

Notes F.T. Actuaries 20 year gilt index 1962-1976
1960 and 1961 values are based on 2½% Consols
1977-1980 values are based on the F.T. Actuaries Index for Gilt Stocks with over 15 years to maturity

TABLE 3

GILTS 5 YRS

The figures below are the amount that £100 invested on December 31 will produce 1 year and 2 years later.

YEAR	After 1 year	After 2 years
1960	99.25	102.19
1961	102.97	102.49
1962	99.53	96.01
1963	96.45	96.26
1964	99.81	99.81
1965	100.00	98.15
1966	98.15	96.9
1967	98.72	97.63
1968	98.90	100.20
1969	101.32	105.46
1970	104.09	99.40
1971	95.49	88.79
1972	92.97	88.46
1973	95.14	99.14
1974	104.20	99.31
1975	95.32	105.34
1976	110.51	104.46
1977	94.52	88.42
1978	93.55	89.06
1979	95.20	
Standard deviation	4.33	5.56

Notes

Values produced by applying a yield curve for 5 year gilts to a stock with an 8% coupon rate.

TABLE 4

GILTS 10 YEARS

The figures below are the amount that £100 invested on December 31 will produce 1 year and 2 years later.

YEAR	After 1 year	After 2 years
1960	99.81	104.93
1961	105.13	104.20
1962	99.11	94.77
1963	95.61	94.80
1964	99.16	98.69
1965	99.53	97.54
1966	98.01	94.50
1967	96.42	93.32
1968	96.79	95.68
1969	98.86	107.16
1970	108.39	102.84
1971	94.87	82.19
1972	86.63	75.82
1973	87.51	99.65
1974	113.86	109.96
1975	96.57	111.23
1976	115.18	100.37
1977	87.14	80.76
1978	92.69	83.90
1979	90.52	
Standard deviation	7.87	9.92

Notes Values produced by applying a yield curve for 10 year gilts to a stock with an 8% coupon.

TABLE 5

GILTS 15 YEARS

The figures below are the amount that £100 invested on December 31 will produce 1 year and 2 years later.

YEAR	After 1 year	After 2 years
1960	104.12	112.20
1961	107.75	105.99
1962	98.37	94.37
1963	95.93	94.35
1964	98.36	95.24
1965	96.83	94.54
1966	97.64	90.18
1967	92.36	84.92
1968	91.94	88.51
1969	96.27	106.25
1970	110.36	100.80
1971	91.33	75.23
1972	82.37	59.55
1973	72.29	85.32
1974	118.02	118.78
1975	100.64	135.04
1976	134.19	111.02
1977	82.74	73.57
1978	88.92	86.76
1979	97.57	
Standard deviation	13.27	17.38

Notes — Values produced by applying a yield curve for 15 year gilts to a stock with an 8% coupon.

TABLE 6

PROPERTY

The figures below are the amount that £100 invested on December 31 will produce 1 year and 2 years later.

YEAR	After 1 year	After 2 years
1960	105.00	110.30
1961	105.05	110.29
1962	104.99	110.24
1963	105.01	110.19
1964	104.93	115.46
1965	110.04	121.01
1966	110.10	121.01
1967	110.04	118.85
1968	108.00	117.72
1969	108.99	123.17
1970	112.99	131.04
1971	115.97	141.50
1972	112.01	97.60
1973	79.99	87.99
1974	110.01	115.51
1975	105.01	123.92
1976	118.01	141.58
1977	119.99	146.39
1978	122.01	134.21
1979	109.99	
Standard deviation	9.02	14.77

Notes

Values based on:

1960 - 66 property index produced by the Economist Intelligence Unit.

1966 - 80 A combination of Pension Funds, Property Unit Trust, Abbey Property Fund and an Index produced by Jones, Lang & Wootton.

TABLE 7

US $

The figures below are the amount that £100 invested on December 31 will produce 1 year and 2 years later.

YEAR		After 1 year	After 2 years
1960		99.85	100.05
1961		100.20	100.41
1962		100.21	100.44
1963		100.23	99.78
1964		99.55	100.00
1965		100.45	116.48
1966		115.95	117.02
1967		100.92	100.23
1968		99.32	99.61
1969		100.29	94.05
1970		93.78	101.94
1971		108.70	109.87
1972		101.07	99.98
1973		98.92	114.81
1974		116.06	137.95
1975		118.86	106.16
1976		89.32	83.61
1977		93.61	84.26
1978		90.01	85.15
1979		94.60	
Standard deviation	1960-79	8.10	12.89
	1970-79	10.60	17.58

Notes

TABLE 8

D.M.

The figures below are the amount that £100 invested on December 31 will produce 1 year and 2 years later.

YEAR		After 1 year	After 2 years
1960		104.23	104.37
1961		100.13	100.92
1962		100.79	100.99
1963		100.20	99.02
1964		98.82	99.98
1965		101.17	116.68
1966		115.33	116.36
1967		100.89	108.64
1968		107.68	109.22
1969		101.43	106.17
1970		104.67	116.16
1971		110.97	132.84
1972		119.71	132.88
1973		111.00	118.38
1974		106.64	140.65
1975		131.88	132.21
1976		100.25	108.42
1977		108.15	102.03
1978		94.34	79.02
1979		83.76	
Standard deviation	1960-79	9.93	15.03
	1970-79	13.19	19.45

Notes

TABLE 9

ANALYSIS OF ASSETS & LIABILITIES BASED ON 1979 DEPARTMENT OF TRADE RETURNS

ALL ITEMS EXPRESSED AS % OF TOTAL ASSETS OF COMPANY

	Land	Fixed Interest		Equities	Depend. Companies		Tax Rec.	Deposits	Ins. Debts	Other Debts	Cash	Other Assets	Ins. Funds	Other Liab.	Solvency Margin	Free Reserves (ex.Solvency Margin)
		Govn Publ Auth.	Other		Ins.	Other										
Large																
1	2.3	13.2	5.1	15.8	25.9	11.1	-	7.7	10.1	8.5	-	0.3	39.6	22.9	4.5	33.0
2	3.9	34.4	18.3	20.7	-	-	-	10.1	4.9	6.3	-	1.4	65.5	3.5	8.9	22.1
3	8.7	19.2	8.0	24.4	3.4	12.4	0.1	6.5	14.4	2.5	-	0.4	74.0	4.1	8.3	13.6
4	9.1	24.1	6.5	20.7	12.9	4.4	1.1	6.0	12.2	2.7	0.1	0.2	61.4	7.0	7.7	23.9
5	3.5	22.7	2.0	4.3	19.9	21.2	0.2	4.0	18.5	3.6	-	0.1	55.5	4.9	7.0	32.6
6	3.4	22.3	8.6	27.3	2.6	1.9	0.1	2.1	20.4	6.2	-	5.1	61.0	5.2	6.2	27.6
7	2.6	20.5	12.0	15.3	2.0	10.5	2.2	9.8	11.5	7.2	-	6.4	52.4	16.7	7.9	23.0
8	4.6	17.4	5.2	19.0	24.2	6.1	1.4	6.3	13.0	2.6	-	0.2	48.2	8.5	7.3	36.0
9	17.9	20.2	7.3	28.3	1.4	0.5	0.3	6.9	15.3	1.8	-	0.1	60.4	4.9	7.5	27.2
10	6.4	31.9	5.5	13.5	7.5	-	2.8	10.1	14.4	6.7	-	1.2	59.5	10.9	7.4	22.2
Medium																
11	10.0	17.2	10.8	28.9	2.4	0.2	1.4	7.0	19.0	2.3	-	0.8	68.4	3.8	10.1	17.7
12	4.6	41.6	3.2	10.7	-	1.0	2.9	12.0	20.8	1.1	-	2.1	74.7	4.1	8.7	12.5
13	6.5	9.8	27.4	9.4	4.2	-	-	23.5	15.7	3.5	-	-	72.9	8.9	5.3	12.9
14	0.1	30.8	5.7	34.6	1.0	0.3	1.2	12.0	13.2	1.0	-	0.1	52.3	16.9	7.6	23.2
15	8.1	14.4	6.4	38.4	3.8	1.3	-	5.1	16.2	5.9	-	0.4	64.1	3.4	8.6	23.9
Small																
16	3.2	18.3	7.9	41.0	-	-	0.8	4.1	24.5	0.2	-	-	64.4	4.3	8.1	23.2
17	-	26.7	16.4	27.0	-	3.2	2.1	19.1	2.6	1.6	1.3	-	57.9	11.4	10.9	19.8
18	13.4	31.3	0.4	1.9	9.6	0.5	3.3	21.6	11.7	4.5	-	1.8	46.4	10.0	14.2	29.4
19	2.7	39.2	2.6	32.2	4.3	-	-	4.0	12.8	1.6	-	0.6	61.7	7.9	6.9	23.5
20	-	12.9	10.6	4.0	-	8.2	1.1	25.5	24.6	2.5	-	10.6	34.6	4.0	7.5	53.9
21	6.9	35.2	26.2	-	-	-	2.8	23.4	2.0	1.3	1.5	0.7	57.1	14.1	11.6	17.2
22	12.5	33.9	10.5	18.2	-	-	0.5	6.7	15.6	2.1	-	-	54.3	3.7	9.5	32.5
23	7.7	53.6	2.3	0.8	1.7	-	1.9	4.8	25.6	1.6	-	-	78.3	1.2	13.1	7.4

Large companies - total assets in excess of £200m
Medium companies- total assets between £50m and £200m
Small companies- total assets less than £50m.