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**LIFE OFFICE INVESTMENT STRATEGY**

**by**

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## **1. INTRODUCTION**

- 1.1 Insurance companies account for about one-half of the entire wealth of long-term UK institutional investors. Some of these assets relate to general insurance arms, but the bulk relates to long term business such as life insurance and pensions. The share of institutional wealth held by life insurers has fallen only modestly over the last 20 years or so (as shown in Figure 1). More than one-half of life office assets are accounted for by just twenty organisations.
- 1.2 Despite, or perhaps because of, this size and influence, the way in which life insurance investments are managed can seem steeped in mystique.

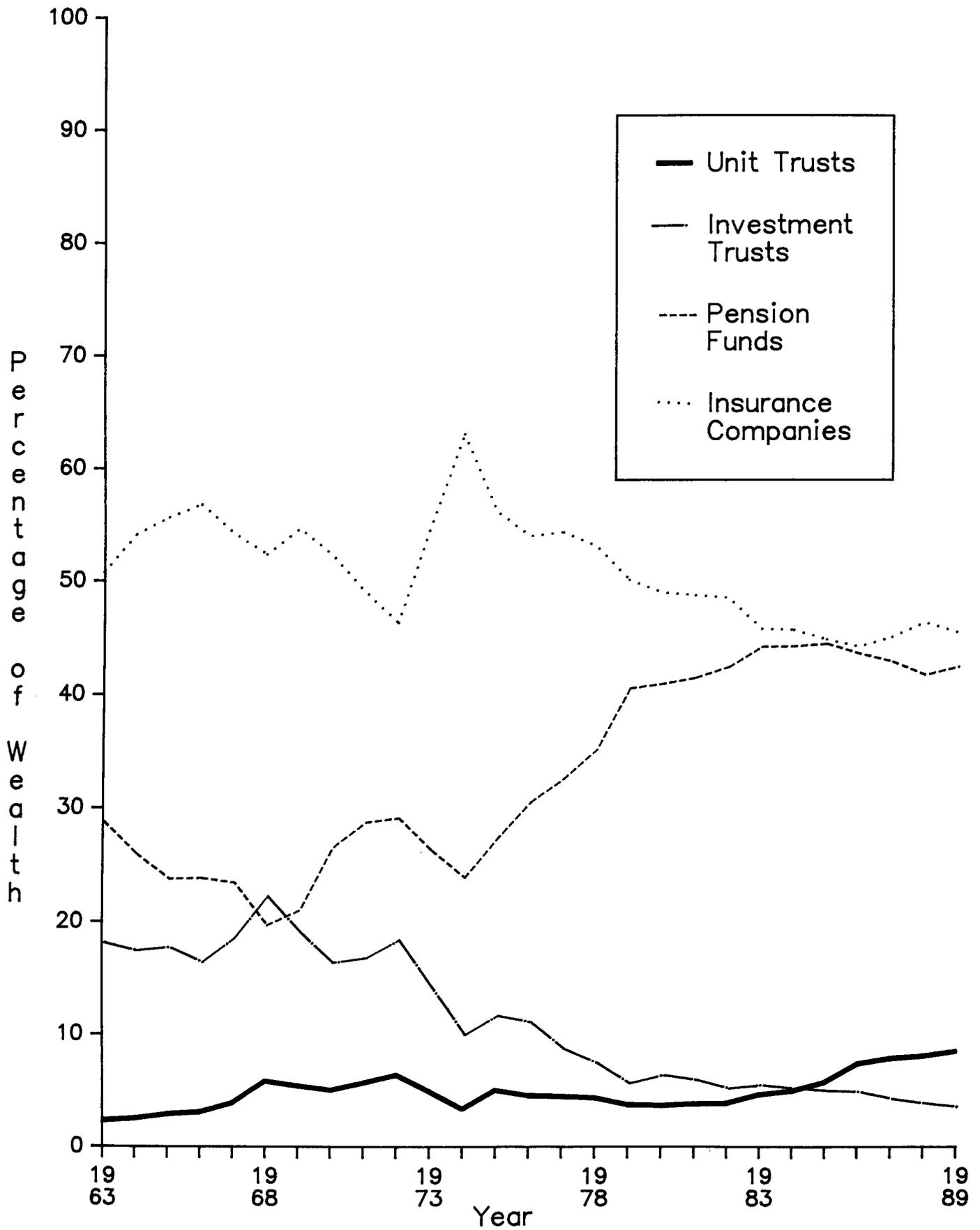
This paper has been written to try to demystify this process and to highlight some areas where I believe some life offices may be "missing some tricks" compared with other investors.

The paper concentrates on areas which I consider are of strategic importance to life offices, such as the long-term percentages held in each major asset category. By necessity the paper skates over many other topics, such as the detailed choice of stocks within individual markets. I hope my perspective, as an investment consultant with a firm of consulting actuaries, will give an unbiased view of how the investment community within life offices behaves. However, if it does not, then the responsibility for omissions and errors is mine alone.

- 1.3 The paper is divided into six sections the first being this introduction. Section 2 sets out a definition of how, in general, any institutional investor might formulate and implement investment strategy. Sections 3 and 4 then cover more specifically how life offices might formulate strategy and how they seem (in practice) to implement it. Section 5 moves onto a slightly different tack, reviewing how derivative instruments (e.g. futures and options) could play a wider role in life office investment thinking. Finally, Section 6 draws all the strands together into a conclusion. The Appendices cover in more depth a number of areas referred to only briefly in the main body of the paper.
- 1.4 Many thanks are due to my colleagues Morfydd Evans, Ian Thompson, Andrew Smith and Howard Frogatt for their helpful comments when drafting the paper and to Mahilesh Dodhia and his team who helped to extract and manipulate the data on which some of the graphs are based.

I would also like to thank Barry Holman for his comments shortly before the paper was finalised and Hugh White, Mark Westley and Nigel De Rivas for providing the initial impetus for this work. They did so by joining me on a Working Party looking at the minimum risk investment positions of life offices, under the auspices of FIMAG/AFIR's Strategic Asset Allocation Group.

**FIGURE 1 : THE WEALTH OF INSTITUTIONS**



Source : Central Statistical Office

## 2. **A FRAMEWORK FOR INSTITUTIONAL INVESTMENT**

2.1 Let us begin with first principles. In broad terms, the framework within which any institution carries out investment activity involves the following:

### (a) **Setting overall objectives**

The reason(s) why there are assets needing to be invested provides the overall rationale behind the shape of any investment policy. Thus, the very first stage is to set clear and appropriate objectives.

This is not as easy as it sounds. There is almost always more than one objective of importance and the different ones will almost always conflict. For example it is impossible at the same time to maximise "return" whilst minimising "risk". It is also usually very difficult to decide what these terms mean. I have set out some alternative descriptions of "risk" to life offices (many of which can apply simultaneously) in Appendix I.

### (b) **Defining a strategic (or neutral) investment policy**

The next stage is to define a "strategic" investment policy (perhaps for each business area separately) best able to reconcile all the main objectives of the office, i.e. to incorporate investment strategy within part of a more comprehensive business plan.

Investment managers often subdivide the totality of investment opportunities into a number of major asset categories or markets, such as UK equities, gilts, etc. Thus, the "strategic" investment policy is usually expressed as a specific mix of these different markets, perhaps changing over time, and probably dependent on the liability structure of the office.

The "strategic" policy can, however, be defined in more detail, e.g. holdings in individual securities might be identified for a closed group of policies needing an immunised or "matched" portfolio (see Appendix I for a discussion of matching).

Another way of viewing this policy is to treat it as the **neutral** investment stance that defines how the assets would be positioned in the absence of any short-term views on markets or stocks. Investment management skills, if they are worth employing, should add value relative to this neutral position.

The neutral investment strategy does not have to match the liabilities closely. It is perfectly acceptable (and common practice) to "mis-match" provided that the risks involved are commensurate with the extra returns thereby expected.

Whether life office senior management are always properly appraised of these risks and rewards is a moot point. To do so requires carrying out some form of **asset/liability analysis**, e.g. as described in Appendix II. Formal analyses along these lines seem to be considerably less common than might first be expected, especially given the actuarial expertise available within life offices.

**(c) Tactical positioning of the asset mix and choice of individual stocks within particular markets**

The main decisions concerning the two previous stages should ultimately be taken collectively by life office senior management, since they have overall responsibility for all the corporate objectives of the life office. Investment expertise is "merely" an essential input to them both, on a par with input from other disciplines.

The investment managers have two more specific day-to-day roles which form the bulk of their work. These roles draw on their presumed expertise in understanding and predicting short-term movements in the values of different investments. They are:

- (i) Identifying whether particular investment markets are temporarily cheap or dear relative to each other. If such opportunities can be correctly identified then the assets can be profitably positioned in a temporary fashion relative to the "strategic" investment policy.
- (ii) Choosing the individual stocks to hold within each investment sector. The "neutral" strategy mentioned in 2.1(b) will have an implicit benchmark for each sector (typically a representative market index). The investment managers should thus be aiming (in each sector separately) to outperform this benchmark, subject to appropriate limits on their scope to deviate from it.

2.2 Both of the roles mentioned in 2.1(c) require day-to-day contact with investment markets, and thus are properly the function of an investment expert. The role of life office senior management in these more "tactical" aspects of investment policy should, I contend, be limited primarily to:

- (a) Placing limits on the scope of the investment managers to deviate from the strategic investment policy. This makes sure that ill-judged decisions by the investment managers do not frustrate the overall business plan of the office and that they are constrained from taking extreme views.
- (b) Setting targets in terms of how much added value (above the benchmark defined by the performance of the strategic/neutral investment policy) the managers are supposed to achieve and over what period.

Targets can be defined not only for the fund as a whole but also for performance within individual sectors/sub-funds.

- (c) Having the performance of the investment managers measured relative to these targets.

Performance measurement fulfils a fiduciary role. More importantly, however, investment managers are attempting to "do a good job" in two areas, namely asset allocation and stock selection. Performance measurement helps to measure how well they have done in both areas and therefore should be broken down or attributed between these two roles.

- (d) Monitoring the major characteristics of the portfolio, to ensure that there is some rationale behind its structure and to ensure that the limits in (a) are being observed.

2.3 Last, but not least, there are some other roles of a more administrative nature which the investment manager will normally control, e.g. custody and dealing. I do not intend to cover these roles in this paper other than to point out that the inability to carry out these roles competently can be expensive to any type of investing institution.

2.4 In practice, of course, the boundaries between these areas are blurred. For example:

- (a) Some managers construct a portfolio from the "bottom up" rather than from the "top down", i.e. they choose stocks that they like and only then check that the resulting portfolio has an asset mix acceptably close to the "strategic" benchmark.
- (b) There is no exact boundary between "strategic" and "tactical" just as it is virtually impossible ever to gain a consensus on what counts as long-term and what is short-term.
- (c) Objectives may be set without assessing what is realistically achievable from the investment side. They may need to be redefined after determining what is actually feasible.

2.5 You will have noticed that I have not yet mentioned **tax**. In practice a very considerable amount of effort is expended in tax planning and many investment decisions are influenced by tax considerations. This is just as true outside the life insurance industry as within it (witness the large number of tax practitioners within accountancy firms).

Tax planning can obscure the overall process described above and distort it, but never entirely eradicates it. Therefore, tax is an important subsidiary constraint

on investment policy. The life office taxation environment is much more complicated than those within which other long term investors generally operate.

I do not intend to cover, except in passing, how taxation might affect life office investment strategy, as many others, more qualified than I, have written at length on this subject within the actuarial literature. Tax rules do, in any case, change from time to time.

### 3. AN OVERVIEW OF LIFE OFFICE PRACTICE

How in broad terms is the framework described in the previous section put into practice within life offices?

#### 3.1 Reviewing Objectives and Setting Strategic Investment Policy

Life offices issue many different types of insurance policies, which are usually collated into a number of broad categories or sub-funds depending on the broad characteristics of the policy. Different sub-funds within life offices are usually treated separately for investment purposes.

##### (a) **Unit-linked funds**

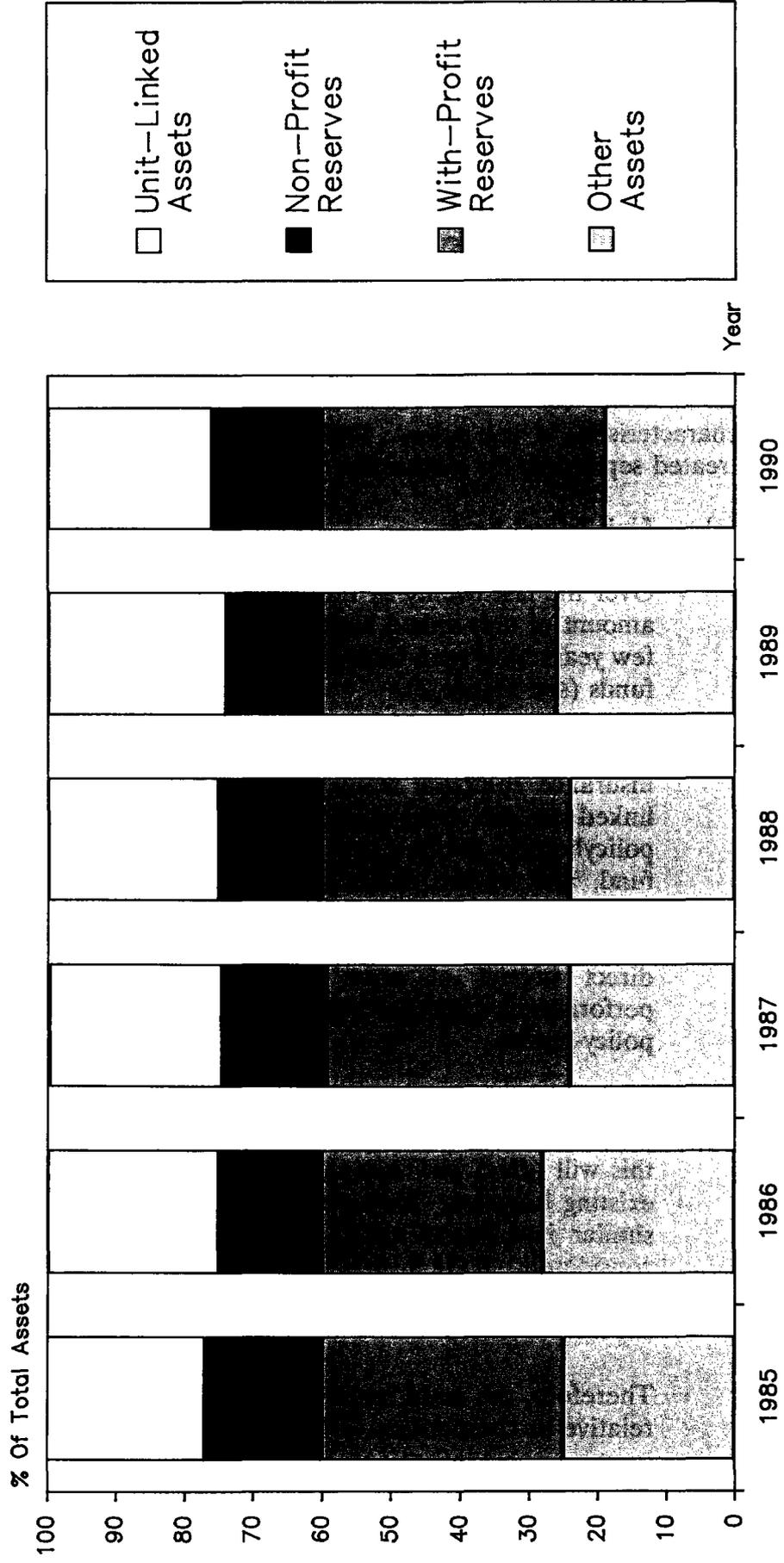
Over the last twenty or thirty years there has been a huge growth in the amount of unit-linked business written by life offices. However, the last few years have seen little further increase in the proportion in unit-linked funds (see Figure 2).

In unit-linked funds (including pooled pension fund assets held in insurance company managed funds) the behaviour of the liabilities is linked to the behaviour of the assets. The amount paid out to policyholders is often precisely the amount of his/her share of the unit fund, and so the assets and liabilities are usually exactly "matched". Assuming the life office does actually invest linked assets in a manner consistent with the policy contract, **the life office is protected from the direct impact of poor investment performance**, since the actual performance (whether good or bad) is passed directly through to the policy-holder.

However, the office is exposed **indirectly** to the effect of adverse performance. If performance is poor, **relative** to competing products then this will affect new business levels and, to a lesser extent, retention of existing business. Direct competitors are usually life offices, but other similar investment media (such as unit trusts) may also need to be considered. Poor investment performance may also reduce the charges that can be levied on the unit-linked funds, and can therefore lead to expense overruns.

Therefore, the main requirement is to provide sufficient outperformance relative to competitors to be able to continue to sell new business, or at least not to underperform so badly that it becomes very difficult to market new policies. The better established players have more to lose by "getting it wrong" and thus are more likely to aim to perform towards the average of comparative league tables, leaving the extremes to smaller outfits wishing to establish a reputation. However, it also helps if:

**FIGURE 2 : WEIGHTED AVERAGE MIX OF BUSINESS  
(of all UK Life Offices)**



Source : Bacon & Woodrow

- the life office has a dedicated distribution channel which can counteract any potential failure to outperform
- policy design is sufficiently innovative to establish a niche position within the market place, or sufficiently frequent to distance the office from its own past failures
- brand loyalty is established, perhaps through marketing

An example of the bunching together of larger players is the pooled pension fund market, e.g. as represented by funds in the Mixed Funds (with Property) section of the CAPS Survey of Pooled Pension Funds. CAPS stands for Combined Actuarial Performance Services Limited; they are one of the two main UK pension fund performance measurers.

The funds concerned effectively all have the same investment objective (to outperform the others in the same or similar surveys). **Nevertheless, the larger the market value of the pooled fund, the closer it is likely to mirror its peers.**

The percentage each pooled fund holds in, say, equities and property can be calculated and the standard deviation of this percentage determined for all funds falling within particular size bands. The smaller this standard deviation is, the more closely each fund mirrors its peers within that section of the market. If the 60 or so companies in the CAPS Pooled Pension Fund Survey at 30 September 1991 are divided into two (by size), then the standard deviation in the larger half is only about 55% of that in the smaller half, i.e. the larger players are more closely bunched together than the smaller ones.

**Variability of  
Investment Strategy  
%**

Largest 30 Funds	5.6
Smallest 30 Funds	10.3

**(b) Non-profit funds (and the "sterling" reserves of unit-linked contracts)**

Reserves for non-profit policies account for only about 20% of the assets of UK life offices (see Figure 2). This reflects, in part, the nature of many non-profit policies (which may have a relatively small investment content compared to the amount of risk cover being provided). It also reflects the growth of unit-linked business (referred to in the previous section).

In the past, it seems to have been usual to compartmentalise non-profit policies and to invest the assets underlying them in a manner which approximates to a matched investment strategy.

However, I have recently seen a different philosophy emerging with the growth in the use of life office appraisal valuations. These assess the overall value of an office to its shareholders (and/or with-profit policyholders). In these valuations, non-profit policy liabilities are often treated as akin to debt securities that a life office might issue (e.g. corporate debentures etc.), since in essence both involve reasonably predictable cash flows that must be paid by the office.

Once this type of view comes to the fore then the non-profit business is no longer compartmentalised, but is instead viewed merely as one type of liability of the with-profit business (or of the shareholders, depending on the ownership structure of the office). The degree to which the assets underlying the non-profit policies look like the liabilities will then depend upon the desired degree of mismatching chosen for the office as a whole (see Section 2.1(b) and Appendix II).

**(c) With-profits funds**

The most interesting types of life office assets, from an investment point of view, are probably the with-profits funds (which include the assets underlying unitised with-profits contracts). The reason is that there is no matching asset class that behaves precisely like these liabilities (or how the policyholders would like the liabilities to behave) and so life offices cannot retreat to repackaging available asset types but must instead carry a significant part of any investment risk themselves.

A few life offices (including one or two of the largest ones) go to a considerable amount of trouble defining their key objectives and how these impact on investment policy, carrying out asset-liability studies to help identify a suitable "neutral" investment strategy for such funds.

However, it seems more common for life offices to analyze their liabilities in a much more broad-brush fashion, using rules of thumb to identify limits within which the investment strategy should lie (usually expressed in terms of percentages in different asset categories). In the UK, the limits usually involve a high proportion in equities and property, even though it is then necessary to establish mismatch reserves (see Section 5.7). This reflects the "cult of the equity" that has become accepted in this country.

These limits provide cover against disaster, but unfortunately leave the investment managers second-guessing where the "neutral" position for the assets should be if every market looks reasonably priced. In such circumstances there is a strong tendency to follow everyone else's lead (see Section 4).

The investment of assets underlying unitised with-profits funds is particularly interesting, because these types of policy share some of the

characteristics of more traditional with-profits policies as well as some of those more relevant to unit-linked ones.

**(d) The Remaining Assets**

The remaining assets include any "estate" not deemed to be included within with-profits funds, and any shareholders' funds. These assets are sometimes owned by the with-profits funds, and sometimes by external shareholders, and sometimes both, depending on corporate structure. A high proportion in equities and property is also common for such funds.

**3.2 Tactical Positioning Between Markets**

Where a clear "neutral" position exists then it is relatively simple to define how tactical positioning should be carried out. Markets that look cheap should be overweighted, and those that look dear underweighted. Provided that the assessment of cheap/dear is correct and the market eventually agrees with the assessment, then the fund should outperform. Precisely how much scope there should be for tactical positioning will depend on how confident the life office is that investment markets really are inefficient (if they are not, then little or no added value would be expected from tactical positioning). The available scope should also depend on the consequences of being wrong (see Section 2.2.(a)).

Life offices seem to use the same sorts of measures of cheapness or dearness as any other investment managers, e.g. trends in p/e ratios, yield gaps, fundamental assessment of investment markets etc.

However, many seem somewhat less capable or less willing than other types of fund management organisations of formulating the logic behind their approach in a succinct fashion that is easily intelligible to outsiders. Although it may sound harsh, many life offices do have the reputation of being "sleepy", relative to the more "go-ahead" image of the investment management arms of financial conglomerates, merchant banks and stockbrokers, even if a "go-ahead" image does not necessarily translate into "go-ahead" performance.

Perhaps this reflects the nature of life insurance business in which funds may be internally sourced and marketing may be less important than for other fund management organisations. The life offices which have been the most successful at distancing themselves from the "sleepy" reputation of their compatriots are those with management structures which leave investment management almost as a separate entity within the organisation.

Alternatively, perhaps this is a conscious decision to build on the general image the public has of life offices which is (hopefully) safe, solid and conservative.

When there are no clear guidelines as to the "neutral" position of the fund, as often seems the case with with-profits funds, then tactical asset allocation becomes

more problematic. If no benchmark or neutral position has been established then it is impossible for a manager to reflect his market view by targeting an overweight or underweight position (as the terms have no clear meaning). To some extent, however, the problems caused by having no clear guidelines are mitigated by the "buy and hold" policy often followed by life offices with equities and property (to avoid crystallising capital gains tax liabilities).

### 3.3 Stock Selection

Life offices, like other investment houses, often employ talented individuals who can be very competent at stock picking. Quite how such individuals choose which stocks to buy or sell can be difficult to rationalise - stock selection is a subjective and judgemental process.

However, the growth in segregated pension funds over the last few years has forced investment managers catering to this market to identify more standardised and systematic approaches that can be applied to many clients simultaneously. The latest symptom in this trend has been the growth over the last few years of what are called **quantitative techniques**. These include indexation, but also include more complex investment approaches. A fuller description of them is set out in Appendix III.

Many life offices do not appear to be in the forefront of such developments (although there are some notable exceptions). Perhaps this is because the flow of segregated pension fund portfolios (which I personally think is a major driving force behind the greater use of quantitative techniques) has been away from life offices towards other investment management groups. Perhaps, however, the cause and effect are the other way round!

Only one of the major UK index-fund managers is a life office despite life offices being able to offer certain advantages over other sorts of index fund managers. Very few appear to have put much effort into applying more enhanced quantitative techniques to help their fund management endeavours.

Once again, it is difficult not to form the opinion that some life offices are complacent in this area. Whatever are the pros and cons of quantitative (as opposed to traditional) management, it does offer rigour to stock selection, possibly at low cost, and this must confer some benefit in the complicated world in which we live.

### 3.4 Performance Measurement

The measurement of pension fund investment performance is now well established in the UK (the first serious measurement services were started in the early 1970's). The market has become dominated by two organisations - Combined Actuarial Performance Services (CAPS, owned by four actuarial consultancies) and the WM Company.

Performance measurement of life offices is, by contrast, more fragmented, and is generally less sophisticated. A few offices do subscribe to CAPS or WM, but many measure their own performance, at least for their main internal funds.

Many advantages accrue from an independent perspective. For example, it becomes much more difficult for investment managers to present themselves in an artificially favourable light. It also helps to ensure that all parties are aware of the targets that have been set and whether they have been achieved. An independent perspective may also help to make comparisons with the performance of other offices more meaningful, bearing in mind the different compositions of the various non-linked funds.

However, in defence of the existing ad-hoc arrangements, it should be pointed out that performance measurement is easier to carry out for gross funds (such as pension funds) than for funds which are taxed. Nevertheless this does not invalidate its use. Rather it means that guidance must be given to the investment managers about what to assume for tax purposes when deciding whether or not to carry out specific investment transactions. Confidentiality may also be perceived as an issue even though in practice this can be accommodated by external performance measurers.

### **3.5 Portfolio Monitoring**

A recent innovation within pension fund circles is the growth of portfolio (and manager) monitoring services. Investment portfolios can often contain a hundred or more stocks, and it can be difficult to identify which of the decisions involved in their construction are the most important.

Although some investment managers have been able to provide reports and other presentations that clearly identify these decisions, most have not. Investment consultancies (in the UK these are mainly departments within actuarial consultancies) therefore prepare analyses which make portfolio construction more intelligible to both laymen and experts. Of particular value are comparative analyses which show how the decisions within one fund differ from those within other funds of the same and different management houses.

In essence this sort of analysis is merely an extension of the concepts underlying performance appraisal. This consultancy product ought to have a limited shelf-life because managers ought to provide the information already. However, they do not (particularly so in the case of life offices) and it does seem surprising to me that more life office boards of directors do not take advantage of such techniques. Perhaps consultancies have found this a difficult market to penetrate.

#### **4. THE DETAILS**

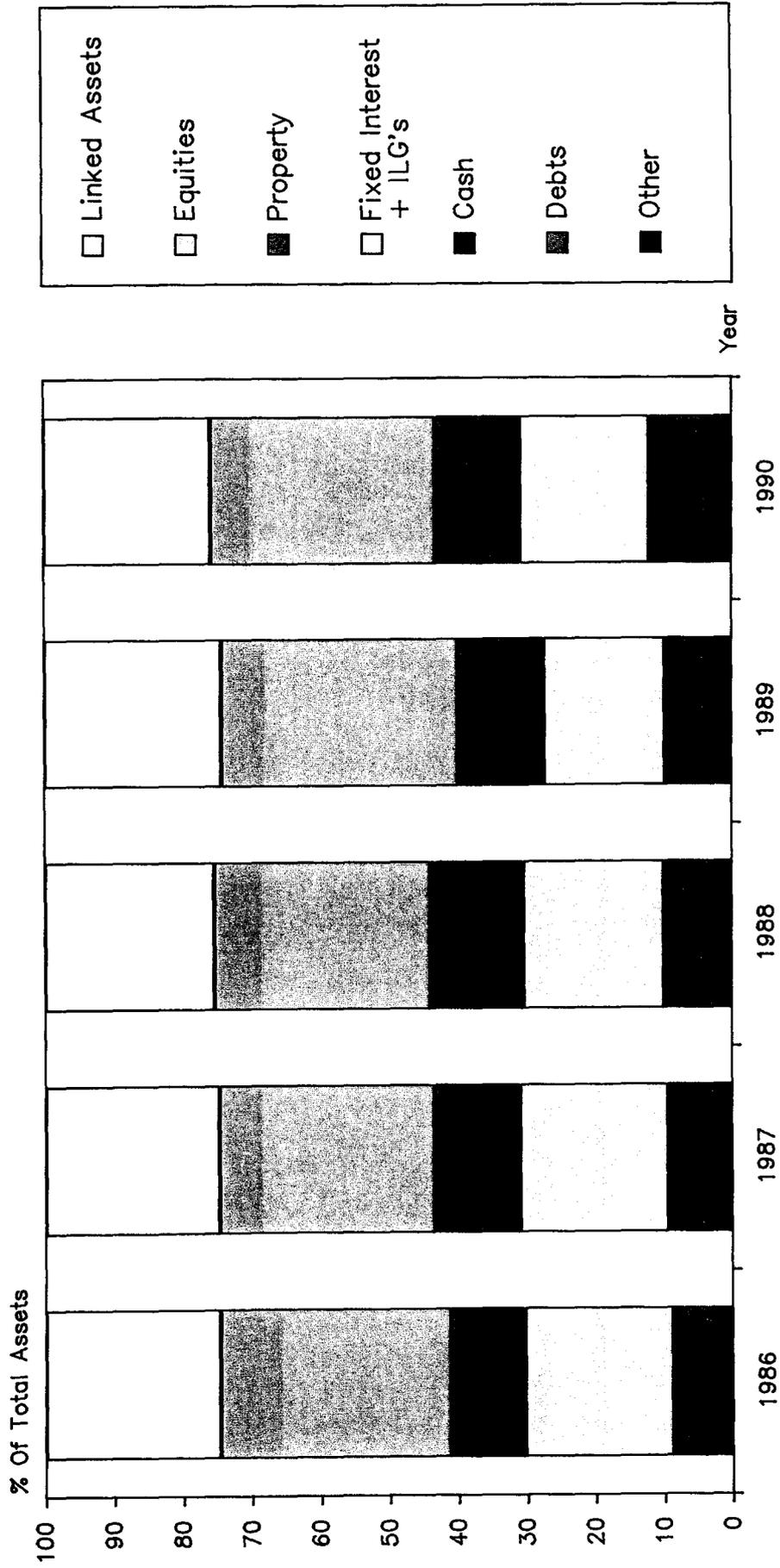
4.1 The previous section explained in broad terms how UK life offices seem to operate in the investment sphere. The details of the strategies they follow can be identified, on an industry wide basis, by using the following sources:

- (a) Information can be extracted directly from the detailed returns all UK insurers are required to submit annually to the DTI. This is a fairly laborious task unless the requirements are limited to a small number of companies. However, it does in theory enable a very detailed picture of the investment policy of entire offices to be built up, so that, say, the with-profits business can be considered in conjunction with other business features such as the level of free reserves.
- (b) More extensive computerised databases are now maintained by organisations such as Bacon & Woodrow containing the major part of the statistical information contained in the DTI Returns for most authorised insurers over the last few years. These make option (a) largely redundant for industry wide analyses as computer databases provide much more extensive and easier interrogation facilities (at least for the computer literate).
- (c) Occasionally magazines such as Money Management summarise certain specific information from the DTI Returns, concentrating on features that they believe are of interest to their readers. These provide a useful source of information, provided that the summary material is sufficient to answer the question in hand.
- (d) Finally, there are with-profits guides published under LAUTRO rules by each with-profits office (and occasional summaries of these within the financial press). Unfortunately, although these guides are supposed to be standardised, there is some latitude in compilation when it comes to expressing asset policy. They do, however, have a major advantage over sources reliant on DTI Returns in that they include a breakdown between UK and overseas equities. Firms such as Bacon & Woodrow also computerise these along the lines of (b).

4.2 These databases tend to relate only to the recent past, but they do show, for example, that the overall average asset allocation of life offices has shown a fair degree of stability over the last five years (see Figure 3). There has however been some upward movement in the proportion of equities backing with-profits liabilities over this period, at least according to with-profits guides (see Figure 4).

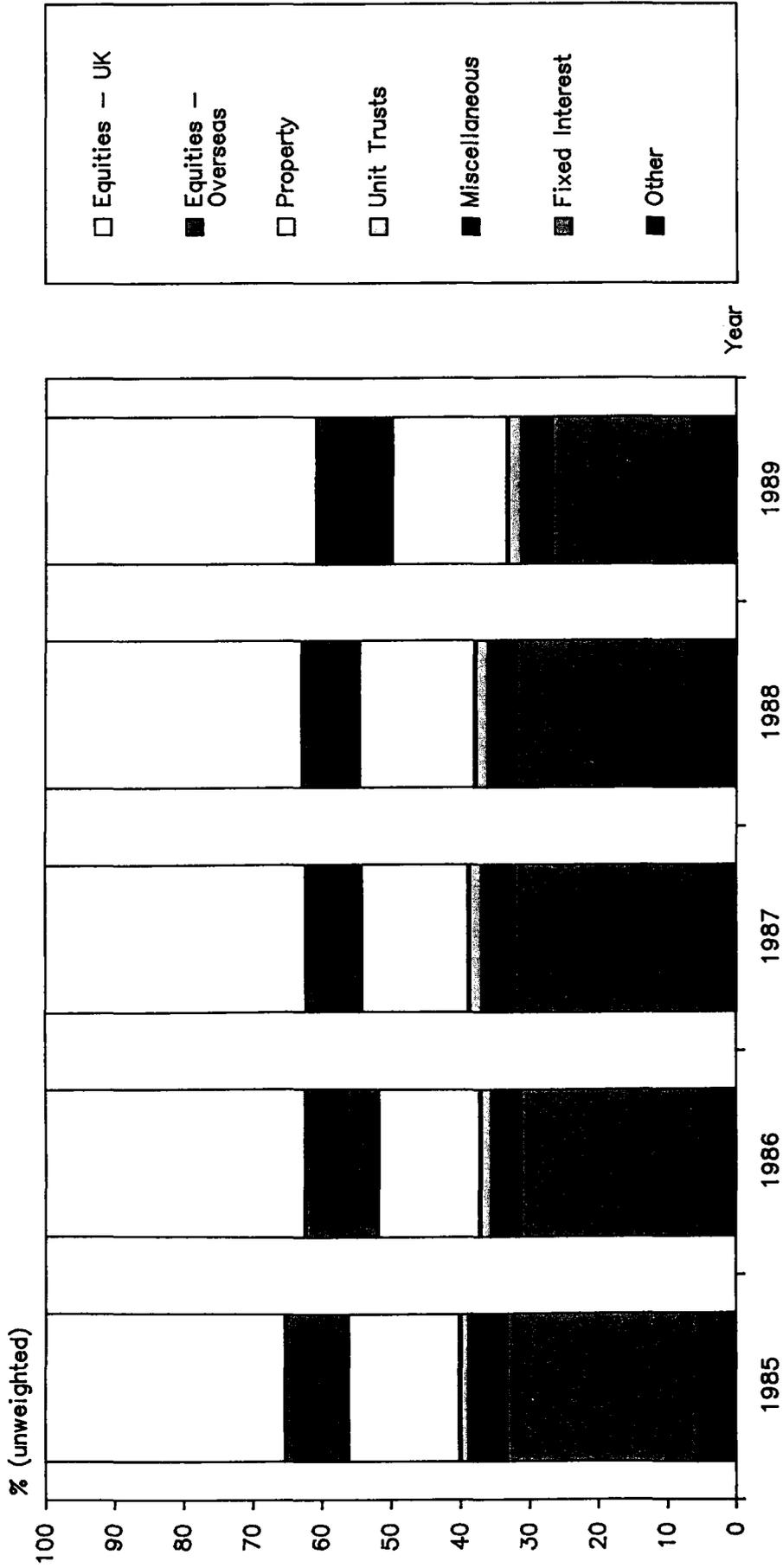
4.3 It is interesting to analyze in more detail how life offices seem to invest their with-profits (and free) assets. In such an analysis it is appropriate to remove linked assets and liabilities from consideration as virtually every life office seems to compartmentalise these as per Section 3.1 (a).

**FIGURE 3 : WEIGHTED AVERAGE ASSET MIX  
(of all UK Life Offices)**



Source : Bacon & Woodrow

**FIGURE 4 : AVERAGE ASSET MIX BACKING WITH – PROFITS POLICIES**  
 (as shown in With – Profits Guides)



Source : Bacon & Woodrow

4.4 Although at first sight it is very difficult to identify any obvious pattern to with-profits investment strategies when considering individual offices, a clearer picture emerges when considering the industry as a whole. Figure 5 shows the most powerful relationship I have identified (at least for large companies). This graph considers the percentage of (non-linked) assets held in equities (and property) relative to the percentage of (non-linked) assets which relate to with-profit liabilities and free reserves taken together. For this purpose free reserves are taken as being equivalent to the "other" assets shown in Figure 2.

As might be expected, the scatter-plot tends to show a broad correlation between the percentage in equities and property and the percentage of assets relating to with-profit and free reserves, ignoring for the moment unit-linked companies. At the end of 1990 companies tended to cluster, at least broadly speaking, around a line formed by:

$$\text{percentage in equities and property} = 75\% \times \text{percentage of non-linked assets formed by with-profit reserves and "other" assets.}$$

4.5 However, the feature I would particularly like to draw attention to in this scatter-plot is how much stronger the correlation becomes as the size of the life office becomes larger. If a regression analysis is carried out (and a line of best fit is calculated) and the spread of asset policies around this regression line is calculated, then this spread is considerably less for the larger companies. It varies according to size of company as follows (fitting different regression lines to each size band):

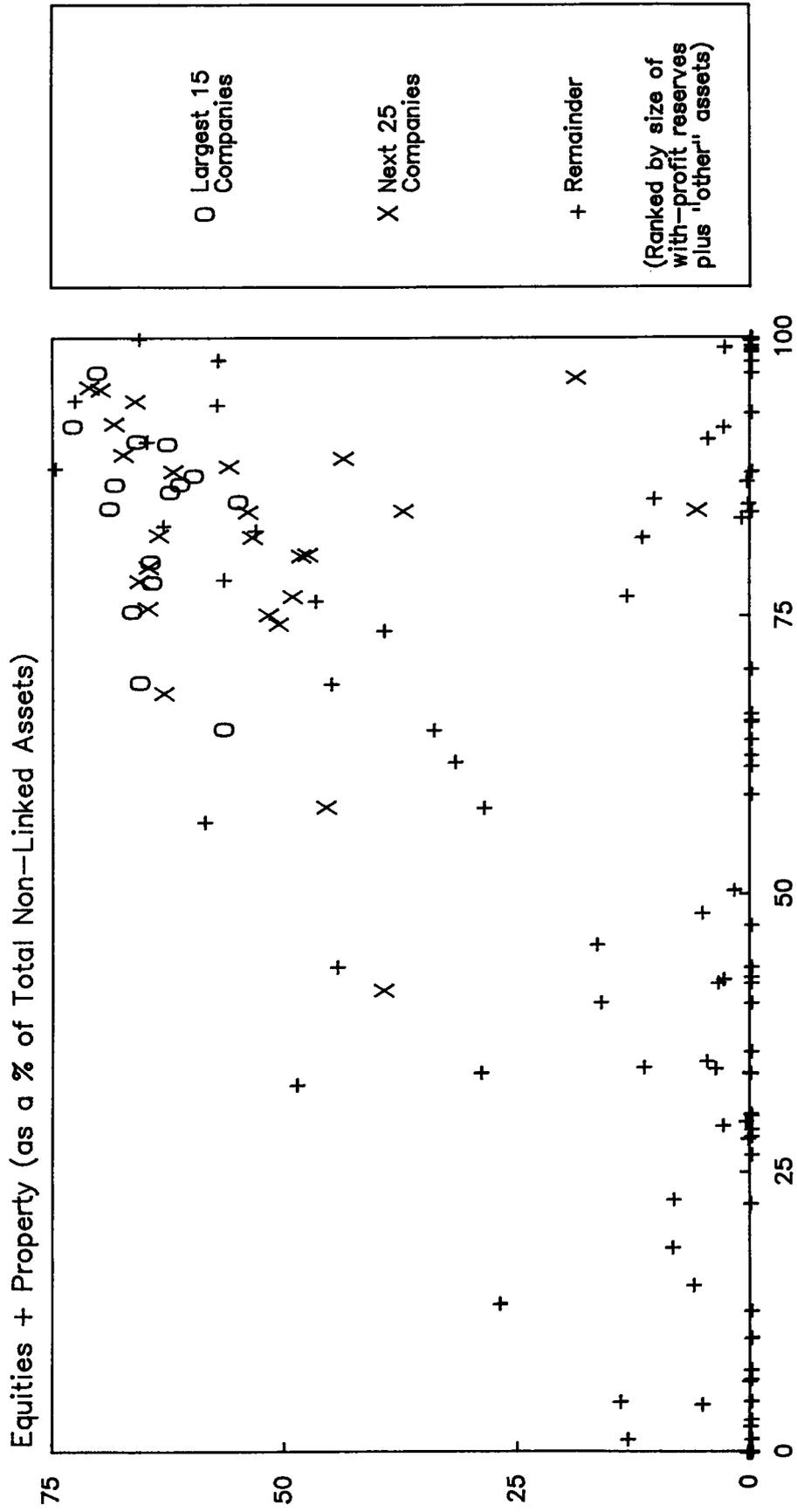
	<b>Observed variation in asset policy (measured by standard deviations) %</b>
Largest 15 companies	5
Next 25 companies	16
Remainder	19

A large number of the smaller companies along the horizontal axis of the graph are companies writing only unit-linked contracts and it is interesting to note that many of them hold little in equities or property whatever their mix between non-profit reserves and "other" assets.

4.5 I think it is not generally appreciated just how much of a tendency there is for large life offices to follow each other when setting investment strategies. If the same calculations are carried out for pension funds then the equivalent variability of asset policy (based on the database of all funds on the CAPS Trustee Service) is about 9%, ignoring any consideration of the liability structure of individual funds.

4.6 I do not wish to place too much emphasis on the precise numerical values of the above figures since the variabilities shown by life offices have been higher at the end of some other recent years. Astute readers will also, by counting the number

**FIGURE 5 : SCATTER PLOT OF INVESTMENT STRATEGIES (1990)**

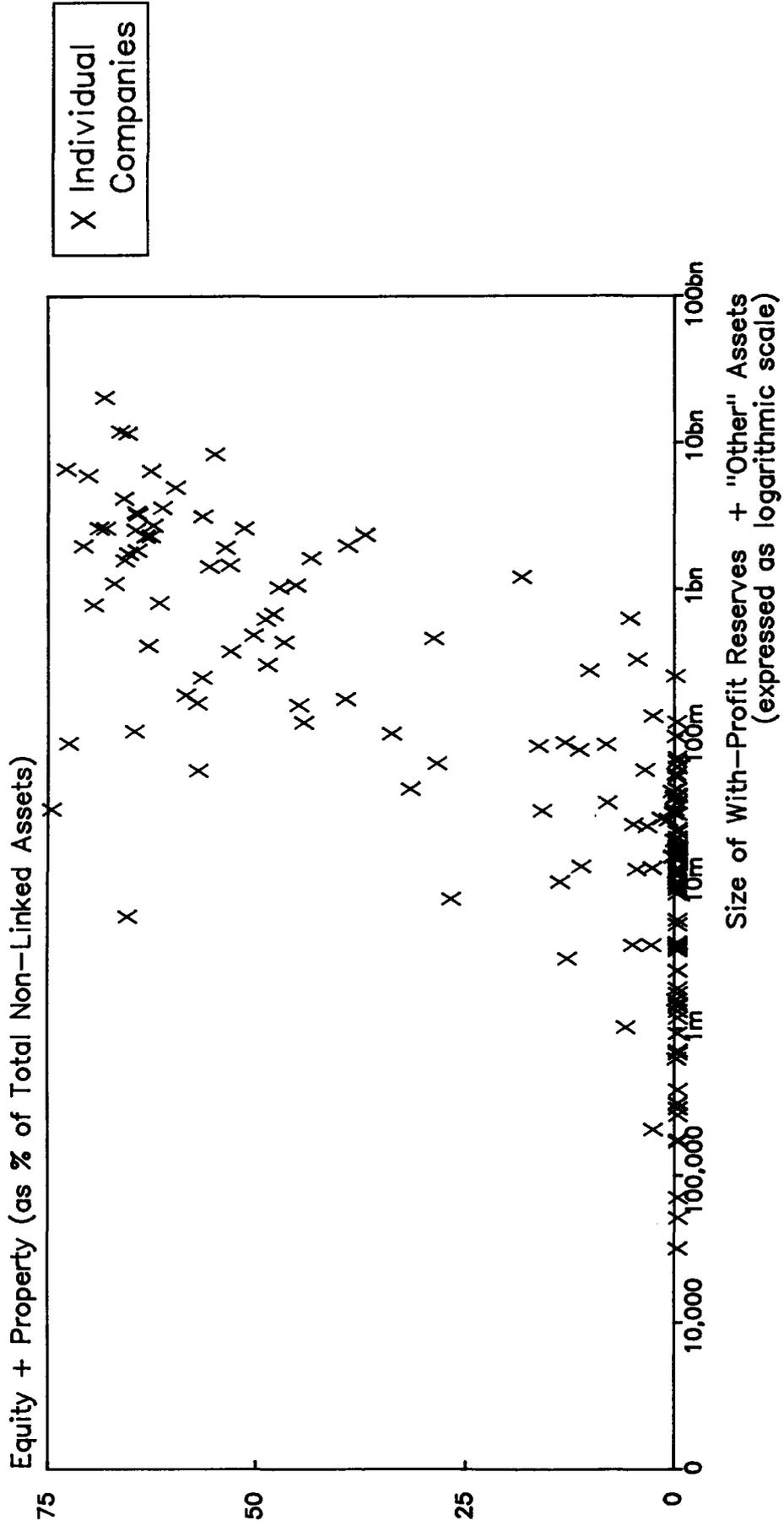


Source : Bacon & Woodrow

of points on the scatter plot, note that the sample I have used contains 168 companies. This covers most but not all of the assets of UK life offices. Additional data is still being added to the computerised database to provide even more comprehensive coverage.

- 4.7 Nevertheless, it does appear that large life offices show a similar "herd" instinct to that exhibited by pension funds. The relative homogeneity of pension fund investment policies is much written about. The equivalent behaviour of large life offices is rather more hidden from the public eye.
- 4.8 An alternative feature of life offices which also seems to be linked to the proportion of assets held in equities and property is the size of the office, as shown in Figure 6. This is presumably because the larger life offices tend to be the older ones and therefore also tend to have a larger proportion of with-profits policies and larger estates.

**FIGURE 6 : WITH — PROFITS INVESTMENT STRATEGY VERSUS SIZE (1990)**



Note : The companies falling on the horizontal axis are primarily unit-linked life offices.

## 5. DERIVATIVE INSTRUMENTS

5.1 In the previous sections I have concentrated in the main on investment strategies which are currently widely used within life offices, and on investment approaches which if not yet widespread will probably become so quite quickly.

However over the last twenty years or so there has also been a creative explosion in new forms of investment instruments, particularly derivatives, which to date have yet to make much impact on the majority of UK life offices (although again there are some notable exceptions).

In this penultimate section I therefore wish to review the uses (and misuses) of derivatives from a life office perspective and to set out why I think they too will become more widely used by the life insurance industry.

5.2 A general overview of the major sorts of derivatives (the term includes both futures and options) is set out in Appendix IV. These instruments were also discussed at some length in a recent paper presented to the Staple Inn Actuarial Society by Paul Hilton called "Investment Management for the 1990's"<sup>[1]</sup>, primarily from a pension fund perspective.

5.3 Derivatives offer life insurance companies opportunities in the following areas:

- (a) tax planning
- (b) circumvention of asset admissibility regulations
- (c) innovative product design
- (d) possibly the ability to reconcile otherwise conflicting objectives, and
- (e) efficient and cost effective substitutes for more traditional means of managing portfolios.

### 5.4 Tax Planning

Derivatives can be classified into two sorts, those which involve obligations on both parties involved in the derivative contract (e.g. futures and swaps), and those where the obligations are asymmetric, falling on only one party (e.g. options).

The former, symmetrical, types of derivative are effectively "off balance sheet" and can therefore often be used to exploit inconsistencies or inadequacies in current tax rules. For example:

- (a) Futures contracts on, say, the UK equity market provide no income to their holders. However, their behaviour is, broadly speaking consistent with the following formulae:

$$\text{CASH} + \text{FUTURES} = \text{STOCK}$$

or equivalently,  $\text{CASH} = \text{STOCK} - \text{FUTURES}$

This shorthand is equivalent to saying "the value of a portfolio consisting of cash plus an appropriate number of futures contracts behaves in a similar fashion to the value of an equivalently sized stock portfolio irrespective of how the stock market moves".

Because futures contracts are not deemed to generate any investment income, it is possible to convert income on cash balances into capital gain by replacing cash with a combination of equities and sold futures positions.

Therefore, in an environment where capital gain is preferred over income (e.g. within a unit trust), or where franked investment income is at a premium, it becomes artificially attractive to hold cash not as actual cash instruments but by investing in equities and selling the equivalent amount of futures contracts. Since the Summer of 1991 it has been possible to hold futures contracts within authorised unit trusts, although very few such trusts have yet been established.

- (b) Instead of investing directly in overseas equities (and thereby incurring withholding tax), an investor can achieve a similar effect either by using futures or by taking out an equity swap contract with a domestic investor in that overseas location. Typically, the return does not then suffer withholding tax.
- (c) An organisation might take out a swap contract which consists of a deal whereby it pays over income on, say, 31 December for a number of years and in return receives income on the following 1 January. As the present values of such payments are essentially identical the net effect of the swap is to defer investment income from one calendar year to the subsequent one.

This particular strategy sounds rather too good to be true, and indeed I understand that the Inland Revenue would probably look through such an arrangement for tax purposes unless there was a commercial reason for the swap.

Not all of the potential variations are therefore effective at reducing the tax liabilities of life offices but the sheer versatility of derivatives does make them potentially powerful tools in this area.

## 5.5 Circumvention of Asset Admissibility Regulations

The Valuation of Assets Regulations govern both the way in which values can be placed on assets and how much credit can be taken for such values in statutory solvency tests. The Regulations were drafted before the creation of most of today's financial derivatives and thus their application to portfolios which hold derivatives can give rise to some very odd results. In my opinion, the Valuation of Assets Regulations need a comprehensive review to cover derivatives

adequately. A possible model would be to use ideas from the Australian Institute of Actuaries, as use of derivatives is more common there.

Some examples of the peculiarities that can arise are as follows:

- (a) The Regulations limit the maximum value that can be placed on **bought** traded options to a small percentage of total assets. However, they do not cover **sold** options (which are not assets as such but liabilities). Therefore, they seem to place no restriction on the selling of options, which can be a potentially dangerous activity. The Regulations do not mention over-the-counter (i.e. non-traded) options.
- (b) Futures are not mentioned at all, perhaps because they have no "market value" akin to the value that can be realised when selling, say, a gilt or an equity (although they do have what is called their market value which is used to calculate the capital gains or losses, i.e. the variation margins, that are payable throughout the lifetime of the future).

Some offices, when completing statutory valuations ignore futures contracts entirely. Others treat the combination of them and cash backing the futures as a synthetic security which is included in the relevant category in the DTI Returns.

If the former approach is used then very strange results are possible. For example, no value can be placed on gold bullion holdings by life offices in solvency tests. However, the same investment effect can be achieved by holding cash and gold futures, and the cash holdings can then be incorporated in solvency calculations. If an investment manager wished to hold gold (presumably considered undesirable by the authorities since it has been excluded from the Regulations) then he or she would presumably find it more attractive to use gold futures than physical bullion.

- (c) The anomalies are not just limited to the value placed on the assets. The rate of interest that can be used to value the liabilities has an upper limit which depends on the income earned on the assets. This can be boosted by replacing equities with the equivalent cash plus futures (a reversal of Section 5.4(b)).

## 5.6 **Product Design**

Options can be used to provide "guaranteed" funds at very limited risk to the life office. The general public places a premium on funds which capture upward movements in stock markets, whilst having a floor on the downside. Indeed this is essentially the attraction that with-profits contracts have over unit linked ones. Holding a portfolio of shares and buying put options (or holding cash and buying call options) gives a portfolio this type of behaviour.

Conversely, a life office structure can be used to enhance some of the investment characteristics of other means of investing using derivatives. For example, I have already mentioned that it is now possible for authorised unit trusts to hold futures and options. These authorised futures and options funds have been very slow to materialise in practice. One reason is that they are viewed as high risk investments and, for marketing purposes, issuers would like to link them with some form of capital guarantee.

The only practical way of doing so within the unit trust sphere is to invest part of the initial funds in a capital bond, which means that the guarantee only actually works provided the combination of bond plus units is held for the life of the bond. Life offices, because they can smooth out ups and downs between policyholders ought to be able to provide a more seamless guarantee to the general public, and should therefore have a considerable marketing advantage with such products (if they want to be associated with them).

## 5.7 Reconciliation of Conflicting Objectives

As discussed in Section 3, life offices often try to pass investment risk onto their policyholders, or to repackage available asset types into vehicles more readily purchased by the public.

However, they are unable to avoid the consequences of poor investment performance on assets backing with-profits contracts, since these assets need to achieve two conflicting objectives, namely:

- (a) maintaining adequate solvency, and
- (b) maximising policyholder pay-outs

Ideally, life offices want to avoid falls in equity and property markets, whilst still gaining the benefit of long-term upward trends in such assets.

This is, of course, precisely the payoff profile of certain forms of **options**, and explains why option pricing theory has sometimes been used to analyze and help decide on bonus policy (e.g. "An Option Pricing Approach to Bonus Policy"<sup>[2]</sup>).

Options are, in effect, insurance policies (in some cases bought, in some cases written) that relate to investments. In theory they can match liabilities which have a double pronged element, dependent on, say, the greater of two alternatives.

Typically life offices hold significant amounts of assets in equities which do not have this sort of downside protection. In the UK there are therefore statutory mis-match reserve calculations which involve assuming a 25% fall in equity values.

In theory, at least over short periods of time, buying **put options** should limit the fall that can occur and should therefore limit the level of mis-matching reserves that need to be set up.

In practice, the current permitted ways of doing mis-match calculations do not appear to allow life offices to take much credit for the potentially beneficial impact of put option positions. This is because admissibility limits on options limit the value that can be placed on these assets in establishing solvency after the hypothetical market value falls have taken place. If there is a dramatic equity market slide then the market value of a portfolio protected by put options will not fall by as much, because the fall in equity values will be partially compensated for by a rise in the value of the options. However, once the options breach their admissibility limits there is no extra benefit coming through in terms of compensation in the statutory valuation calculation.

Interestingly, the problem of admissibility can be overcome by holding cash plus call options (which provides effectively the same behaviour as holding stock plus put options). This is because the call option value only becomes significant if equity markets rise, which is not tested for in the solvency test.

I am not aware of any life office which has invested large parts of its assets in cash plus call options for this purpose, although I have come across one or two life offices who have been sufficiently close to falling below their solvency margin to make this type of strategy potentially attractive.

## 5.8 **Efficient and Cost-Effective Substitutes for More Traditional Means of Managing Portfolios**

Futures and options also offer some advantages more specifically related to the investment management function.

For example, futures alter asset allocation. The alternative is to buy and sell the underlying assets. The main advantages (from a purely investment point of view) claimed for futures are:

- (a) **Speed and liquidity.** It is possible using futures to buy and sell exposure to many markets much more quickly and in much larger volumes than if each underlying stock needed to be bought or sold.

In the case of overseas markets, even a relatively small move (say 1% or 2%) of the overall portfolio value can represent a very significant portion of the holdings in an individual market, and so buying or selling the underlying stocks can be very disruptive to a manager's stock selection if the move is made quickly.

The impact on a market of a single futures deal is also often much less than that of a series of individual transactions, especially in times of rapidly moving markets.

- (b) **Low cost.** It has been estimated that dealing in futures is up to six times cheaper than carrying out the equivalent deals in the underlying stocks. This cost saving becomes particularly attractive when the deal is likely to be reversed in the relatively near future.
- (c) **Diversification.** Wide diversification can be obtained with a single holding on an index futures contract.

5.9 Options, being more complex, can also be more versatile than futures. They can be used as substitutes for:

- (a) **Portfolio protection.** Buying a put option is equivalent to purchasing insurance against market value falls.
- (b) **Top-slicing.** Many investment managers claim to set a price above which they will liquidate their holdings (because the holdings will therefore have risen by as much as they expect might occur or because an individual holding may become too significant a proportion of the total portfolio). Some proponents of options have argued that selling a "covered" call option at this price is equivalent to locking in this decision, and receiving a premium for doing so. Whether investment managers actually formalise the original decision process in as rigid a way as this is a moot point. The argument also assumes that option holders will always exercise their options immediately the share price exceeds the exercise price and this does not necessarily happen in practice.
- (c) **Underwriting.** A commitment to buy stock at a set price even if it falls below that price on issue is in many ways similar to selling put options.
- (d) **Gearing with warrants.** Buying a call option provides the same sort of payoff as investing in warrants.

5.10 However, the greater complexity of derivatives (particularly options) means that they need to be monitored more carefully than other sorts of investments. Furthermore, they have fixed and in most cases relatively short life times and thus may need "rolling over" regularly.

Substantial steps forward in techniques for proper monitoring of futures and options have recently taken place, with the development of guidelines covering both reporting and performance measurement by LIFFE (in conjunction with Bacon & Woodrow<sup>[3]</sup> and Mercer Fraser<sup>[4]</sup>).

5.11 A final development in the sphere of options which is often of particular interest to senior management in life offices has been the development over the last few years of **share option schemes**. These generally involve the issue of the office's own stock in a manner designed to provide appropriate incentives to staff. Even non-proprietary companies can, in theory, jump on this particular bandwagon, by establishing phantom schemes designed to provide payments as if the office had been proprietary. The effective cost of option grants (or phantom option grants) can in theory be calculated using option pricing techniques but the long term nature of such options makes it difficult to establish suitable assumptions to use in the pricing process.

The majority of life offices do not seem to have been major users of share option arrangements even though they can be versatile (and sometimes tax efficient) components of remuneration packages.

5.12 Taking an overview of the whole derivative scene it seems to me that most life offices were until recently no different from other long term investors (such as pension funds) in viewing them with caution. Recent clarification of the tax position of pension funds using derivatives means that many more pension fund investment managers and trustees are becoming much more interested in derivatives. I do not yet see the same sudden sort of boost in enthusiasm within life offices, even though derivatives may in fact be more useful to them than to pension funds. However some growth in interest does seem to have occurred of late.

Both life offices and pension funds lag far behind corporates in their use of derivatives. Swaps and other derivatives are now widely accepted treasury management tools, though not always successfully used!

## **6. CONCLUSIONS**

- 6.1 I hope that this paper has helped to illuminate some of the factors at work within life office investment strategies.

Many introductory actuarial textbooks on the subject seem to treat matching as the most important determinant of life office investment strategy. In practice, as with other long-term investing institutions, matching often plays second fiddle to competitive pressures.

How else is it possible to explain the wide diversity between the typical levels of, say, equities held by similar types of investors in different countries? Each has a separate herd instinct - a fact that will make for plenty of interesting work when herds merge, such as with the arrival of the EC single market for life insurance.

- 6.2 Many life offices have in general been rather complacent in responding to some of the newer analytical techniques now appearing in the investment field. Although these approaches do not necessarily improve investment performance they certainly make it more intelligible.
- 6.3 Most UK life offices have also been somewhat slower at showing interest in derivatives than other long-term investors. Derivatives offer some particular attractions to life offices, and may be capable of being blended into life office structures to competitive advantage.
- 6.4 However, existing regulations (for life offices) in the derivatives area are inadequate or illogical and I believe need to be reviewed.

If this is carried out then I believe it would also be appropriate to review and extend the information on assets that life offices are required to provide in DTI Returns. The current Returns contain far more information on liabilities than they do on assets. Many of the life office problem cases of recent years have been driven towards the rocks not by liability-led influences but by unwise investment policy.

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## APPENDIX I

### LOW-RISK/MATCHED INVESTMENT STRATEGIES

#### 1. Matching

A key idea in investment is the concept of **matching** of assets and liabilities. Normally an institution will have specific liabilities which it must meet at future points in time, and it has a fund of assets (plus potentially future new money) to meet these liabilities. The assets and liabilities are said to be **perfectly or exactly matched** if the cash receipts from the assets (including income and capital gains) in any small interval of time in the future are exactly the same as the cash outgos required to meet the liabilities falling due in that time interval, **irrespective of future economic or investment circumstances**.

Perfect matching is a largely theoretical concept. About the only common situation where it occurs in practice is with unit-linked policies (or managed funds). The policyholder is normally entitled to exactly his or her share of the unit fund and thus whatever movement occurs in the assets is exactly mirrored in movements in the liabilities.

More realistic is close or partial matching (by currency, say, where the assets held in a particular currency are similar in amount to the liabilities) or **immunisation** (where the institution is protected against uniform shifts in yield curves). Many actuaries have written on these topics, e.g. Reddington<sup>[5]</sup>, Morrison<sup>[6]</sup> and Wise<sup>[7]</sup>.

However, a note of caution is appropriate. The solvency of life offices is assessed not on cash flow criteria, but on whether they meet statutory solvency tests carried out on assumptions upon which restrictions are placed. Although the two calculations should perhaps give the same result, this is not always the case. Inconsistencies between the regulations governing the valuation of assets and of liabilities can distort the simple cash flow matching described above.

#### 2. Different Types of Risk

As it is not usually possible to find assets that perfectly match the liabilities a more useful concept in practice is often to consider a **low risk investment strategy**. However, before identifying what might be low risk for each type of liability it is necessary to identify what exactly we mean by investment "risk" for a life office. Possibilities include the risk:

- (a) of becoming insolvent
- (b) of failing to pay "reasonable expectations"
- (c) of underperforming industry averages
- (d) of having inadequate diversification, or having undue exposure to a single situation/event

- (e) of market value falls
- (f) as measured by variability/standard deviation of nominal (or real) returns
- (g) of sector performance below the index

In practice there is no consensus definition of what is risk - it is in the eye of the beholder. Even among the members of the FIMAG subcommittee mentioned in Section 1.4 there was no consensus. Long term concepts such as the need to avoid becoming insolvent, or of failing to pay "reasonable" expectations seemed currently to be of particular importance. In practice, as I have pointed out elsewhere in this paper, performance relative to competing life offices is actually much more important than might at first be expected.

### 3. Low risk/Matched strategies

The following assets were, our working party thought, low risk for the specified liabilities, assuming the policy was a single premium contract. If it is a regular premium one, many of the liability components are matched by future premium receipts.

<b>Liability Type</b>	<b>Assets that best match these liabilities</b>
(a) unit-linked	the appropriate linked assets (plus assets to match "sterling" reserves, if necessary)
(b) guaranteed, non-profit	gilts (there is a problem if the liabilities are too long to be able to purchase suitable gilts, but this problem may possibly be reduced by effectively gearing the portfolio). Annuities increasing in line with the RPI would be matched by index-linked gilts
(c) guaranteed element of with-profits liabilities (accrued bonus)	gilts. For the first few years the matched position might be zero, as the value of premiums to be paid in the future could be greater than the value of the guaranteed sum assured and accrued bonus (and there may be no reserve required)
(d) future reversionary bonus	the sub-committee considered that equities or other equity type assets (i.e. index-linked gilts and property) were probably the best match to provide policyholders with protection against future inflation. However, for policies like low cost endowments, where protection of the current level of bonus may be important, a fixed interest/gilt component might be

appropriate. In practice most of these liabilities will be matched by future premiums

- (e) future terminal bonus as per (d), with greater freedom available, the higher the proportion of bonus being paid as terminal bonus
- (f) expenses perhaps index-linked gilts, or perhaps assumed matched by new business, unless the expenses will be paid in the near future
- (g) estate (i.e. any remaining assets within long-term business fund)
  - policyholders' part include in (d) and (e)
  - shareholders' part include in (h)
- (h) shareholders funds (outside long-term business fund) there is no obvious solution. Perhaps any target (e.g. all equities or a mix such as 70/30 equities/gilts) is acceptable provided it is stated in the report and accounts. Quoting embedded value calculations may affect the conclusions.

## **APPENDIX II**

### **ASSET/LIABILITY STUDIES**

1. **An asset/liability study (or "modelling" or "coordination", the terms are generally used synonymously) is a formal process designed to highlight the way in which an institutional investor might progress under various alternative scenarios. It usually involves projections of the behaviour, not only of the assets and liabilities but also of features that depend on them and that are of key importance to the office, e.g. profits and/or solvency margins.**

Usually a desire to define investment policy is paramount. However, the same technique can also be used to analyze any other aspect of the business over which senior management have some control, and has wide applicability to many different types of institution. For example, the Stochastic Model devised by the Institute of Actuaries' Working Party on General Insurance Solvency<sup>[8]</sup> could be classed as a tool for carrying out such exercises. The major use that actuaries have made, to date, of such techniques is to help pension fund trustees choose suitable strategic investment policies. "Asset-liability modelling" is also a well recognised technique within banking and treasury management circles.

The application of this technique to life offices is particularly interesting since offices have reasonable control not only over investment strategy but also over other factors such as bonus rates on which the future liabilities depend.

2. **The projections of the life office may be carried out just for a few specimen scenarios. However, with the advent of extensive computer power, it is now more common to carry out Monte-Carlo or stochastic simulations in an attempt to understand more fully the likelihood of achieving whatever objectives the study is concentrating on.**
3. **The approaches used by different actuaries carrying out asset/liability studies seem, in the main, to follow a common structure:**
  - (a) **key objectives are identified (typically subdivided into those which seek to maximise "return" and those which seek to minimise "risk", possibly allowing for the variety of forms these two factors can take).**
  - (b) **the factors that affect the organisation but are outside its control are analyzed in detail, and modelled in some way. In the context of determining investment policy this usually involves analyzing the liability structure to determine how these liabilities might behave under possible future economic scenarios.**
  - (c) **a low risk or matched investment strategy is identified, which minimises the risk of failing to meet the objectives identified, based on the analysis**

carried out in (b). This involves pairing off different types of liabilities with corresponding sorts of assets which behave in a similar fashion irrespective of future economic and investment scenarios.

- (d) sensible mis-matched long term investment strategies or benchmarks are identified (with one extreme being the matched strategy in (c)). The aim here is to limit the number of investment policies that might be adopted to some manageable number, given the millions of possible ones that could in theory be chosen.

This stage can be carried out using very simple rules of thumb. Alternatively, it can involve more complicated calculations, of which the most common is some form of computer optimisation procedure to find those portfolios which have the lowest level of "risk" for any specific expected level of "return".

The mathematics are akin to the "efficient frontier" underlying Modern Portfolio Theory originally developed by Markowitz, except that "risk" is defined in terms of how far the behaviour of the assets and liabilities might be liable to deviate from each other. Therefore cash or treasury bills are not normally low risk assets (except when applying the techniques to banks and similar organisations).

- (e) the potential effects of adopting the asset distributions identified in (d) are assessed, usually in terms of the likelihood of meeting different key objectives. Essentially a sophisticated "what-if" exercise is carried out.
- (f) finally, a suitable long term investment strategy is chosen bearing in mind the results of the "what-if" exercise.

There are, however, all sorts of variations on this theme. Most of them are either related to the different assumptions adopted by different practitioners, or to the degree of sophistication of the "what-if" exercises. These can range from just a few illustrative examples to highly sophisticated stochastic projections of many thousands of possible simulations of what might happen in the future.

- 4. The type of asset/liability study mentioned above effectively starts from a "low-risk" investment position. It is also possible to carry out asset-liability exercises starting from two other positions, namely:

- (a) **A high risk position**

In this approach the impact of adopting a high risk strategy (typically an extreme position on the efficient frontier in 3(d)) is assessed. Usually the high risk strategy is too high risk (e.g. the risk of default is too high), and a suitable strategic investment policy is then in practice determined by moving back down the efficient frontier until the level of risk is acceptable

or,

**(b) The default position**

This starts from where the portfolio would be by default, and then moves up or down the efficient frontier depending on whether the institution ought to be able to take greater or lesser levels of liability related risk than the average. Assumptions have to be chosen so that the default policy is actually on the efficient frontier, but otherwise the formal mathematical part of this approach is virtually the same as for the other two. The presentation, or development of the "what-if" exercise can, however, end up being simpler.

5. In practice most institutions carrying out asset/liability studies tend to revert towards the default. The commercial risk to which managers themselves are subject gives a strong impetus to this (as discussed elsewhere in this paper) and institutions can also gain comfort from not being far out of line with similar bodies (even in the face of the danger that the entire industry is heading in the wrong direction).

It is therefore almost always necessary to bear in mind an analysis along the lines of 4(b) even if the study is ostensibly following principles more along the lines of 3 or 4(a) of this Appendix.

6. Whatever type of asset-liability study is undertaken, it is necessary to identify what is a low-risk or matched investment strategy. Details of what our FIMAG/AFIR sub-committee concluded were low-risk for each type of life office liability are set out in Appendix I.
7. Asset-liability exercises essentially formalise how to identify the amount of (liability-related) investment risk that a life office can adopt. They are excellent tools for helping senior management understand the implications of their decisions, even if the application of their results needs to be tempered so that the investment strategies chosen do not deviate too far from those followed by other similar offices. Their main disadvantages are:
- their results can be sensitive to the assumptions being adopted, many of which may be imprecise,
  - they can be quite expensive, especially if the "what-if" exercises involved are very sophisticated, and
  - such studies for life offices can be more complicated than for pension funds because of the greater variety of control measures and the need to allow for taxation.

**However, if an office wants to understand what is the implication to its business of the default adopted by the rest of the industry, or to position itself away from its peers, or even the implication of different industry groupings coming together (e.g. as might happen as the EC single market develops), then some form of asset-liability analysis is an invaluable tool.**

## **APPENDIX III**

### **QUANTITATIVE INVESTMENT TECHNIQUES**

1. **Quantitative** (or **systematic**) investment management aims to select assets according to rigorously defined procedures which can, in theory, be replicated or standardised across many portfolios simultaneously.
2. The most obvious quantitative style is the **indexed fund** which attempts to perform in line with a recognised market index, giving up the opportunity of outperforming the index, but also minimising the risk of underperformance.

An index fund can be established for any market or sector for which an investible index exists, and there are even "consensus" index funds which utilise index funds within individual markets and allocate the assets between different markets in line with the average distribution of the relevant investor type.

Conceptually the easiest way to set up an index fund is to purchase each and every stock in the index in the same proportion as it is represented in the index. This can prove expensive to administer, and many index fund managers instead use statistical sampling techniques to obtain a portfolio with fewer holdings that can still be expected to behave closely in line with the relevant index.

3. Statistical sampling techniques do not, however, have to be applied to the market as a whole, but can instead be used to provide **tilts**. A portfolio which would otherwise be an index fund can thus be biased towards defined characteristics (e.g. a high ratio of book value to price). To be used effectively (i.e. to add value consistently over a straightforward index fund) the managers need to:
  - (a) identify characteristics (such as book value to price) which might be useful predictors of the behaviour of the return on the asset. This can involve considerable amounts of data extraction and cleaning.
  - (b) identify which of the characteristics analyzed will perform well in the near future.

The second of these often relies on more subjective criteria. It is therefore often difficult to divorce these so called active quantitative approaches from more traditional investment management methods. Indeed, many more traditionally managed portfolios are now analyzed using quantitative techniques to identify what sort of tilts they contain and how close or far they are away from looking like an index fund - the answers do not define what the manager does, but are a useful check for them. Quantitative screens are also regularly used by traditional managers to exclude stocks with undesirable characteristics from further consideration.

4. Some quantitative managers go further, establishing more detailed rules for determining which tilts or even which markets to buy and sell. These systems may be driven by economic inputs, past history and may not include any element of forecasting.
5. A few investment managers have taken quantitative investment management along a somewhat different path. They deliberately avoid tilts or sector "bets" or other ways in which their portfolio might differ from the benchmark index but instead seek to add value by selecting the cheapest way of gaining exposure to individual stocks. Exposure to the equity of many of the larger companies in the UK, USA and Japan can be obtained in a variety of ways (e.g. by use of warrants, convertibles or derivatives). By expert choice of the most attractive means of gaining exposure at any point in time, some of these investment managers have produced exceptional outperformance. How long this can continue depends on how rapidly others learn to arbitrage away such imperfections in investment markets.
6. I suspect that the search for a computer program that will always deliver investment outperformance is no more likely to succeed than searching for the Holy Grail. However, the process of quantitatively analyzing what is actually happening within a portfolio, and allowing it to influence choice of assets does seem to me to be no less effective than applying technology to other fields of human endeavour. It does not always work and is not always cost-effective, but in moderate doses it is almost invariably a useful tool.

## APPENDIX IV

### FUTURES, OPTIONS AND OTHER DERIVATIVES

1. Futures and options have a long history - an entrepreneur in ancient Rome is reputed to have cornered the grain market by judicious use of such contracts (although this may be an apocryphal story).
2. However, even until about twenty years ago, the only **tradeable** futures and options that existed in any quantity were commodity related.

This changed with the development of **financial futures, forwards and traded options**. Instead of depending on movements in the price of grain, petroleum and other commodities, the behaviour of these contracts depends on or "derives" from movements in the price of financial assets, such as stocks, shares and currencies. They are thus known collectively as "derivatives".

Contracts can be traded either on a formal exchange (e.g. the FT-SE 100 index future traded on LIFFE) or outside any specific exchange (like the huge volumes of currency forwards traded informally on the foreign exchange markets).

3. The last decade or so has also seen an even larger explosion in the use of derivatives by banks and corporate treasury departments. The most important such derivative is the **swap**, which involves two parties "swapping" one form of income stream for another. The first swaps involved swapping fixed interest payments for ones which were floating in line with interbank rates (taking advantage of anomalies in how different capital markets might view a company's credit rating).

More recent versions may also involve swapping interest payments in one currency for interest payments in another, and/or placing caps, collars or introducing options within the swap contract. Derivatives exchanges have also been quick to develop complementary products - the most actively traded contracts on LIFFE are their interest-rate contracts.

4. A **financial futures contract** or **financial forward** enables an investor to gain (or shed) exposure to a specific type of financial asset without actually buying (or selling) the relevant investment type. In order to do this the contract involves two parties establishing a legally binding arrangement in which one party is obliged to purchase a standard quantity of the relevant asset from the other at some specified future date, at a price agreed now, and the other is obliged to sell it at that price and at that time in the future.

Because the price is agreed at outset, the investor who is committed to selling the asset is protected against future changes in the price of the asset, even though the asset has not actually changed hands. The corollary is that the investor

committed to purchasing the asset has become exposed to price movements in the asset without yet owning it.

The primary difference between a "future" and a "forward" is that futures are traded on recognised exchanges, limiting the risk of default of the other side to the transaction (but therefore requiring returnable deposits from both parties, called a **margin**, to be paid to a central **clearing house**; margin payments often occur throughout the lifetime of the contract and not just when it commences or expires).

Forwards are not traded on a recognised exchange, and are generally considered more susceptible to default risk.

5. With a future or forward both parties are required to carry out certain actions under the contract.

In contrast, in an option contract the obligation is one-sided - the **buyer** of the option does not need to exercise the option if he does not want to, whereas the **seller** is obliged to carry out his obligations if required by the buyer.

As well as two types of transaction (buying and selling) there are also two types of traded option - **puts** and **calls**.

**Buying** a **put** option gives the manager the right to sell specific assets at a given price and at a given time, whilst **buying** a **call** option gives the manager the right to buy specific assets.

Most traded options have only a relatively short life-span (e.g. three to six months). Longer term options (sometimes of five years or more) are available on a bespoke basis from investment banks, but these, like forwards may be exposed to greater risk of default.

6. **Swaps** can be considered as theoretically equivalent to a whole bundle of forward contracts, one for each separate item in the payment streams being swapped. The more complicated swap-type contracts, including those with caps and collars can in theory be viewed as suitable combinations of both forwards and options.
7. Derivative contracts are significantly more difficult to understand than more typical asset types. They can be analyzed using pay-off diagrams from which it is possible to establish mathematical formulae that they ought to satisfy, e.g. the equivalence of:
  - (a) CASH + CALL OPTION, and
  - (b) STOCK (or FUTURE) + PUT OPTION
8. The pricing of tradeable derivatives is driven by market forces. However, futures and forwards also offer arbitrage opportunities, and so in most circumstances their

prices remain within certain bounds driven by the value of the assets underlying them.

Few equivalent underlying securities include any sort of option (exceptions are convertibles and warrants) and so it is more problematic to determine appropriate "fair" prices for options. The most important option pricing formula is that of Black and Scholes<sup>[9]</sup>, which makes certain assumptions about how the values of the underlying assets behave. There are a number of other formulae that make more complicated (and perhaps more realistic) assumptions, or which allow more accurately for idiosyncrasies in the option contract being analyzed (see e.g. Blake<sup>[10]</sup>).