

Actuaries and Assets

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"In the second paper the authors tackle a problem that is very much in the air at the moment - that of matching assets to liabilities"

1. INTRODUCTION

- 1.1 The above quotation is 35 years old - the earliest which came easily to hand without painstaking research. The remark was made by J W Sutherland FFA in the discussion on a paper to the Faculty of Actuaries by D J Robertson and I L E Sturrock. Mr Sutherland went on to say that "this is no new idea" and I am confident there are earlier versions of the same message.
- 1.2 This short introductory paper asserts that not very much progress has been made since then; indeed that assets have been neglected to an alarming degree. Only now, 150 years after the inauguration of the profession in the UK, is sufficient attention being devoted to the question of assets and their close connection with liabilities. There is a lot of ground to make up and we actuaries had better hurry. For reasons mentioned later, we have a golden opportunity.

2. LIABILITIES

- 2.1 Let us start at the beginning, namely with the liabilities. I mean here the liabilities of a major institution such as a pension fund (my own background is in pension funds and they are the prime topic of this paper). What are liabilities? They are most emphatically not a "present value". Rather, they are future cash flows. Present values arise purely from the needs for (i) computational speed and feasibility and (ii) simple presentation. As such they are only means but unfortunately they appear to have achieved the status of ends.

2.2 This status surely has a limited life expectancy; what is computationally feasible has been transformed out of all recognition in the last two decades, and in my opinion present values, far from being simple to convey, have always caused presentational problems. It may not be long before present values are almost a thing of the past, with the emphasis switching to emerging costs, ie projections of future benefit outgo (as illustrated in Figure 1).

3. ASSETS

- 3.1 What are assets? Perhaps less obviously they too are future cash flows. The first point to make is that assets exist for one reason and that is to finance liabilities. Without liabilities, there is no need for assets; this simple fact should be enough to warn us that assets are all about liabilities.
- 3.2 To digress for a moment, sometimes there are liabilities without assets (other than a future capacity to pay). State pension schemes are almost universally depicted as having liabilities in that there is an inviolate commitment to pay, but there are no corresponding assets. It is perhaps ironic that State pension schemes represent a major example of an emerging cost approach - in sophisticated countries benefits are projected many years ahead - when for the very reason that there are no assets it would be instructive to know the present value of the liabilities taken on, if only to add to the National Debt!
- 3.3 Assets exist for liabilities. Indeed they are the mirror-image of the liabilities. All payments made to extinguish liabilities must be made from assets (whether investment income, maturity proceeds, or sales); all assets not required for current benefit payments are there for later benefit payments and have no other purpose. (For convenience surpluses or deficiencies are ignored. Future contributions are discussed in paragraph 11.3 below.) There is a one-to-one correspondence between assets and liabilities.

3.4 The future cash flow projection that is the liabilities is also therefore the future cash flow projection that is the assets. It is true that a more common projection of asset cash flow would have two different features; firstly the pattern of maturities would be unlikely to include sales of equities or other irredeemable securities and secondly the income from these securities would be shown as continuing for ever. Thus the asset and liability cash flows would look unequal (see Figure 2). However this situation can be rectified (indeed at some stage must be rectified) by appropriate redistribution, reinvesting assets which mature too early and selling assets which mature too late (until Figure 2 becomes Figure 3).

4. ACTUARIAL VALUATIONS AND ASSETS

4.1 For many years, assets were brought into actuarial valuations at cost. This is an entirely irrelevant figure but was excusable initially because cost and anticipated maturity value were subconsciously or even consciously assumed to be of similar value. As time went on it became less excusable but by then actuaries were hooked on present values and the divorce between assets and liabilities was upon us.

4.2 In more recent times, market value has been used. This is an equally irrelevant figure but if liabilities are looked at as present values then an appropriate choice of discounting rate could mean that in present value terms consistency can be achieved between assets and liabilities if market values are taken. (However, the choice of discount rate is rarely made with such consistency in mind!) Market values or a smoothed version of market values are now enshrined in legislation in some countries (eg USA for pension fund valuation, UK for life assurance fund valuation).

4.3 The only way to treat assets is to look at the cash flows they produce. (These cash flows may or may not be discounted; under a present value approach they would be.) As far as I am aware, this approach was first mooted in 1947 by

C E Puckridge in a paper to the Institute of Actuaries; the approach is now becoming common (and is recognised in the legislation for UK pension funds but not life assurance funds).

5. ACTUARIES AND INVESTMENT PERFORMANCE MEASUREMENT

- 5.1 At least in the UK pension fund world, actuaries are heavily involved in the field of investment performance measurement. The work they carry out, however, is not uniquely actuarial - it is, in essence, straightforward arithmetic and algebra which could be both devised and carried out by any competent schoolboy mathematician, centring upon making reasonable approximations for cash flows in the calculation of a rate of return achieved on assets. (Were it not for cash flows, the percentage rate of return would be simply $100 (M_1/M_0 - 1)$ where M_0 is the opening market value and M_1 is the closing market value including the value of investment income in the period concerned.)
- 5.2 The actuarial role is thus a coincidence and represents the seizing of a business opportunity. Furthermore, the role played is deficient in actuarial terms; in other words there is a genuine actuarial content to the matter, which is almost universally ignored. This is that the performance assessed takes no account of the risks taken in achieving it, even though these risks are predominantly actuarial in nature and specific to the liabilities in question.
- 5.3 There is also a conceptually dubious assumption in using market values as the sole criterion for performance. In the very long term market values matter; however calculations are usually carried out at quarterly intervals and presented and discussed at quarterly, or at best annual, intervals as if market values were the only test. This is analogous to assessing a corporation's performance as being "dividends paid plus change in share price" (rather than, say, profits or earnings per share); the concept is fine in the long term but rarely used in the short term - and rightly so.

5.4 To add insult to injury, the very respect in which short term market movements do matter is commonly dismissed by actuaries as something which does not matter! (See Section 8 below.)

6. ACTUARIES AND INVESTMENT STRATEGY

6.1 The role of actuaries in institutional investment has always been powerful in the UK. In life assurance companies, actuaries were and are strongly represented in top management, often to an overwhelming degree. It was natural that this influence should encompass the investment function, and in the days when non-profit policies dominated the scene, the science of matching assets against liabilities, according to outstanding duration, was widely used as an instrument of control.

6.2 Entirely outside the concept of matching, actuaries were also involved as skilled investment managers. As far as I am aware, our profession was the first to be examined in investment, and actuaries were to the fore in assessing likely returns on a scientific basis and in constructing diversified and coherent portfolios.

6.3 Actuaries working for the major pension funds also became interested in investment, and many say that it was an actuary (George Ross Goobey) who was responsible for the "cult of the equity" which developed following his strong move into ordinary shares (common stock) for the pension fund of the Imperial Tobacco Company in the 1950s.

6.4 Perhaps the cult of the equity together with the change in the denomination of liabilities away from "fixed money" to real, salary related, or bonus dominated, tended to downgrade the status of the old matching concept. In UK pension funds, it is virtually non-existent apart from some general mumblings along the lines that "real liabilities should be financed by real assets".

- 6.5 The replacement has been Modern Portfolio Theory (MPT) the genesis of which is usually credited to Markowitz some 20-25 years ago, and the essence of which is that (i) risk and reward are directly correlated (ii) risk is price volatility - almost always taken as short term (eg 1 month) price volatility. I argue below (Section 12) that both of these concepts are invalid replacements for matching theory, although they may well be useful tools of investment management.
- 6.6 In UK life assurance, the position is better in one way but worse in another. The validity of matching is recognised (still with particular reference to outstanding duration) but unfortunately its use with the Net Premium method of valuation (insisted upon by the authorities as the main tool for regulation) results in wrong answers because Net premiums are not related to the future cash flows which are the cornerstone of matching theory.

7. AN ACTUARIAL PUZZLE

Actuaries are good at mathematical puzzles. I would be grateful for an answer to the following actuarial one.

There are two UK pension funds, A and B, which at 30th September 1987 are identical in every respect save one. This is that while A is invested in the ratio 9:1 in equities and bonds, B's ratio is 5:5 (both ratios are based on market values). Actuarial valuations covering accrued service (on full projected salaries) and existing assets, have just yielded identical results, including a healthy surplus of 5 per cent of assets.

During the next three months, equities fall in value by 30 per cent (gilts rise by 5 per cent) and the Trustees hurriedly call for new valuations.

Again the valuations show identical results. (The Actuary had some problems deciding what the result should be but eventually left the 5 per cent surplus intact.)

The actuary concerned then dons his performance measurement hat and discovers that fund A's quarterly return was (-25 per cent) while B managed to achieve (-11 per cent), some 14 percentage points better than A.

One gentleman happens to be a Trustee of both funds. A meeting is arranged for the Trustees and the Actuary and the following conversation ensues between the common Trustee and the Actuary:

T: How is it that the actuarial positions remain identical when B has outperformed A by 14 percentage points?

A: I do not use market values for valuations. They are

T: You did in 1984.

A: Yes, but I do not now. They are too fickle. What really matters is income earning power and this is unchanged.

T: I suppose so. And you are quite happy that both schemes still have a small surplus?

A: Yes.

T: Well that is something. Let us turn to investment performance. Manager A seems to have been pretty dreadful.

A: You should not read anything into a single quarter's results.

T: No but he is in the bottom quartile over 5 years. I think we should sack him and move to Manager B.

A: That would be silly. That is all down to the last quarter. Manager B has usually been down there as well - in fact slightly below A for most of the time, until these last few months.

T: Oh. They are both poor then. I have never felt comfortable with either of them. I have been talking to another investment manager who has an excellent record over many years. I think we should sack both managers, cash the investments, and give the money to him.

A: I cannot quarrel with that.

T: That is that then. Now you are sure that we are still OK actuarially speaking are you not?

A: You did say cash the assets and pass them over didn't you?

T: Yes.

A: And naturally you would expect the performances of both funds to be identical henceforth?

T: Of course.

A: Well Fund B will start off with 19 per cent more money than Fund A and will retain its lead. I really think in these circumstances I will have to use the value of the cash as my asset value. In which case Fund A has a big deficiency.

T: Does that mean that the company will have to inject some funds?

A: Well it ought to really.

T: I do not think that is on.

A: Well, you do not have to transfer cash. That is expensive anyway. Just transfer the assets and everything will be OK.

T: But surely that is just playing games. The manager will still provide the same performance from now on. He will get out of cash and into his normal position pretty quickly anyway.

A: I suppose you are right. Well you had better leave well alone with Fund A. Just appoint the new manager for Fund B.

T: But then we are sacking the best one and keeping the worst one.

A: Yes, I suppose you are. But really this performance measurement stuff is a bit suspect.

T: What do you mean? You recommended it.

A: I know.

T: Perhaps we should not change anything at present.

A: I am sure you are right.

T: Good, that is that then. I am thirsty.

The puzzle is solved by spotting the errors. The situation is represented pictorially in Figures 4 and 5.

8. ACTUARIES AND ASSET/LIABILITY CO-ORDINATION

8.1 In my view the above discourse is too close to the truth for comfort. The basic fault lies in lack of co-ordination between approaches to assets and liabilities. There must be consistency in actuarial evaluation, and there must be consistency on the asset side between actuarial evaluations and investment performance measurement.

8.2 Changing market values should not necessarily be reflected in actuarial reviews, but the failure to reflect a relative change in equity and bond prices is serious. We must assume that funds A and B will either have similar future performances or not. If the latter, why? If the former, then an actuarial valuation must reflect the change which has taken place.

- 8.3 In my opinion we must assume similar future performances and hence the actuarial valuation should reflect the relative change which has occurred. This is achieved by switching the assets notionally into a "matched" position at the valuation date. The switch must be made through market values and this is the means for reflecting the change. The evaluation of assets will then proceed by looking at estimated future cash flows in the normal way.
- 8.4 If (and only if) a scheme is already in a matched position, market value changes have no effect. Otherwise, they do. This after all is what mismatching is about; taking risks about profits and losses and accepting their consequences.

9. A MATCHED POSITION

- 9.1 How do we find the matched portfolio? That is a matter mainly for consideration outside this paper. A lot of useful work is being done at present and a lot of progress is being made. In essence, a matched portfolio is one which is affected by changes in conditions in the same way as the liabilities are so affected. The matched portfolio is specific to the liabilities in question. Fixed money liabilities can be matched by bonds. Price-linked liabilities can be matched by index-linked bonds (which are available in the UK). Salary-linked liabilities can be matched by what? That is the hard part but most people say equities or property or other assets with "economic growth" potential. The assumptions made about the future income stream from the various asset classes in changing economic conditions (changing interest rates, changing inflation rates) then enable a matched portfolio to be found - the one which least disturbs an actuarial valuation result after the change has occurred.
- 9.2 The practical justification for such a portfolio is that if the actuarial valuation means anything at all, the deviation between actual liability cash flows and asset cash flows is minimised by its adoption.

10. INVESTMENT STRATEGY AND ITS MONITORING

- 10.1 This does not mean that a matched portfolio should be adopted. It does mean, however, that it should be identified, and that investment strategy is expressed in the form of deviations from the matched (or neutral, or benchmark) portfolio.
- 10.2 This deviation can be large, quite validly. It could be large if the fund has surplus assets. It could be large if very strong views are held that deviation will bring commensurate gains. It could be large if the sponsoring employer has a high risk/reward profile (but see 12.3 below).
- 10.3 My main point is that the actuary is central to this process (as an actuary). He is best qualified to determine the matched portfolio and he has a role in deciding upon the deviations, because he can quantify their effects.
- 10.4 The investment measurement process must follow this approach. For example, if two funds have decided to follow a minimum risk approach, which entails a different asset mix for each of the two (because of different liability structures) and if the difference in performance achieved in a particular period is solely due to this factor, then the difference is not a difference!
11. "YES, BUT IN PRACTICE....."
- 11.1 In the UK Pension Scheme world, three arguments are often raised against the proposal of determining a matched position and expressing and monitoring investment strategy in the form of divergence from this position. All of them accept the theoretical argument but suggest it is unnecessary or impossible in practice. (But surely if a theory does not work in practice it is not a good theory in the first place?)
- 11.2 The first argument is that the vast majority of pension funds are long term and salary-related, so that a generally "real" asset stance is all that is required for matching purposes. I doubt if this argument was ever true and it certainly is not now. My guess would be that if the

proportion of bonds and inflation-linked stocks (versus "equity" type instruments) required for a matched position were calculated for the largest 1,000 (say) UK pension funds, there would be at least 10 percentage points difference between the upper and lower quartiles, and probably nearer 20 per cent.

11.3 The second, rather similar argument is that since most pension funds are growing via new money, the matching-by-duration concept falls down; indeed it may be impossible to invest "long" enough. In fact funds are maturing fast and the new money argument is often quite weak. In any case it is a flawed argument. The prime purpose of setting aside segregated assets is to provide benefit security - were it not for this a pay-as-you-go or book reserve system - as still commonly used here in West Germany - could be used. The assets set aside for a segregated fund have only one purpose which is to back accrued liabilities, and the investment strategy for those assets should be set accordingly. Furthermore, the fact that no liquidity pressures are seen in the near future does not reduce the need to consider matching - to argue against this is rather like saying "Please God make me chaste but not yet".

11.4 The third argument is that like it or not investment performance measurement is now well embedded and overall rates of return without adjustment for risk are part of the environment. My answer to this is short and sharp - let us change the environment before it gets even more embedded!

12. THE OPPORTUNITY

12.1 I stated in paragraph 1.2 that we actuaries have a golden opportunity to get in on the assets act. This sounds cynical but in fact I think that adjective is better used to describe many of the actuarial moves on assets in the past. The role I envisage is truly actuarial and it is crucial.

- 12.2 How does this opportunity exist? It exists because while we have been going up the wrong road, so has MPT. Although the mathematical theory of MPT permits volatility to be measured over any period and permits any risk-free standard, in fact it has been applied almost universally under the assumptions that volatility is measured over very short periods and that cash is a risk-free asset. On the back of these misguided applications (misguided for most pension funds at least) has been built a set of Asset Allocation models which are themselves misguided.
- 12.3 In the first place, as every actuary knows, cash is not a low risk asset for most pension funds. In the second place, again as every actuary knows, short term volatility is of limited concern to most pension funds. In the third place, as every actuary does not know (or at least does not question) there can be no straightforward relationship between risk and reward - basically because risk is in the eye of the beholder and reward is not! One investor could decide that a fixed income bond is less risky than an inflation-proof bond (because his liabilities are similarly fixed) while another could decide the opposite. Both are right. Their risk rankings are opposed. Over any given period, however, they will each receive the same reward from the fixed income bonds, and they will each receive the same reward from inflation proof bonds. Their reward rankings are the same, even though on the risk/reward hypothesis they should differ.
- 12.4 This whole edifice is beginning to crack. Hence the opportunity. Hence also the danger; we must be quick, because when things crack they soon come tumbling down. In the USA the investment management community is already beginning to see the error of its ways. Can the actuaries act quickly enough? The portents do not look good - generally speaking they are not involved. I am not aware of any actuarial influence on FASB 87 but I assume there was some if only a little. One effect of FASB 87 is to bring asset/liability co-ordination into the limelight. Two cheers for that. But it also

seems to enshrine the present value concept and the market value concept and it replaces cash by long term bonds as the low risk benchmark. A boo for that but from a narrow professional viewpoint, at least it gives US actuaries time to make an impact.

- 12.5 In the UK it seems to me that we have a greater respectability, and perhaps we also have a little more time. But have we enough time? Only time will tell!

APPENDIX

ACTUARIES AND ASSETS

ASSUMPTIONS UNDERLYING FIGURES 1 - 5

FIGURE 1

This figure depicts the anticipated cash flow arising from a group of pensioners all aged 65 plus a group of deferred pensioners aged from 55 to 64. There is no allowance for commutation.

Deferred pensions increase at 5 per cent per annum to retirement (age 65). Once in payment, pensions increase at 3 per cent per annum.

FIGURE 2

The liabilities are as in figure 1. The asset cash flow depicts the income arising from a portfolio of fixed interest stocks and equities. The fixed interest stocks are of terms up to 20 years with gross redemption yields of 10 per cent per annum. Equity dividends are assumed to rise at 5.5 per cent per annum.

FIGURE 3

The liabilities are as in figure 1. The asset cash flow shows the income arising if the assets are rearranged so as to fully match the liabilities (except for a small item of surplus).

FIGURES 4 AND 5

The market value proportions at 30th September are 90 per cent equities, 10 per cent gilts for Fund A and 50 per cent equities, 50 per cent gilts for Fund B. At this date, the actuarial value for both gilts and equities is taken as exactly equal to the market value.

The notional matched portfolio is (in terms of actuarial values) 50 per cent equities/50 per cent gilts.

Gilts are valued over a 15 year term. Equity dividends are assumed to rise in line with inflation (taken as 5.5 per cent per annum).

Following the fall in market values, actuarial values (relative to market values) are assumed to increase correspondingly.

FIGURE 1

ACTUARIES AND ASSETS

Pension Scheme Liability Cash Flow

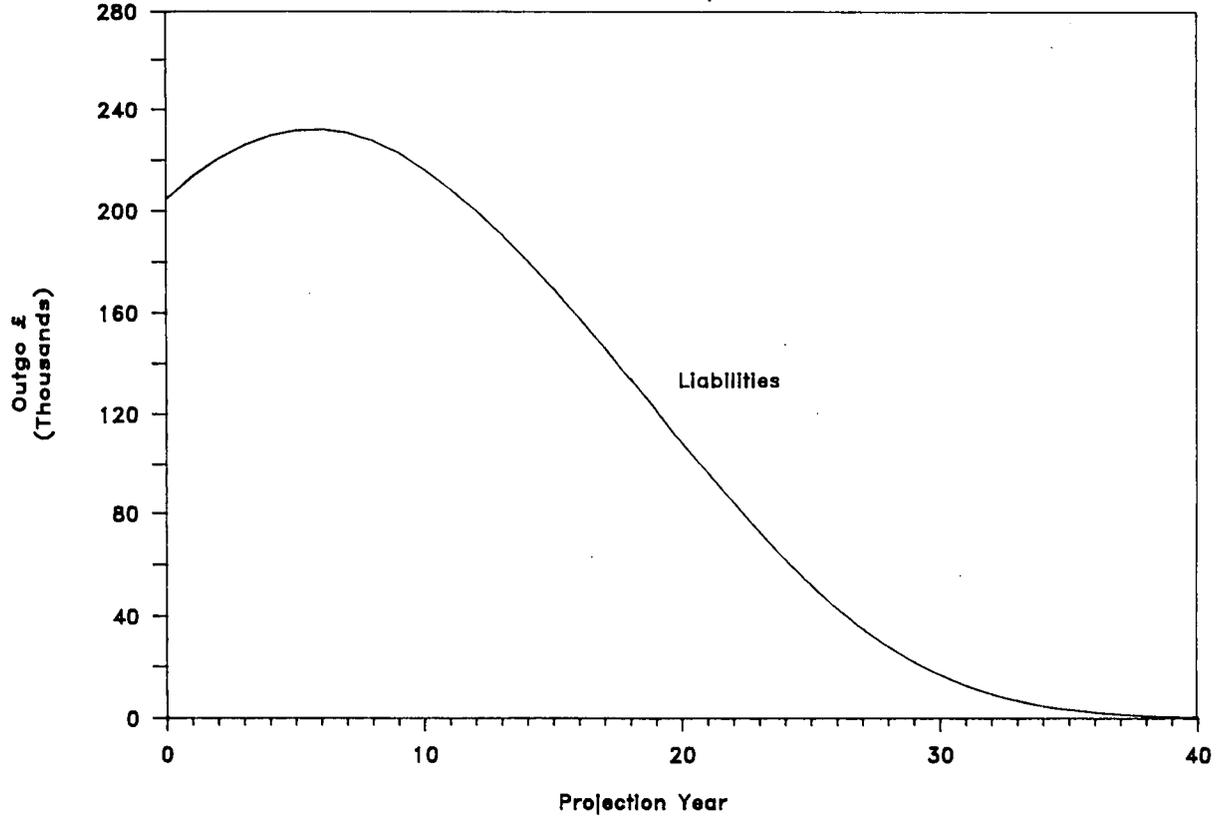


FIGURE 2

ACTUARIES AND ASSETS

Pension Scheme Cash Flow

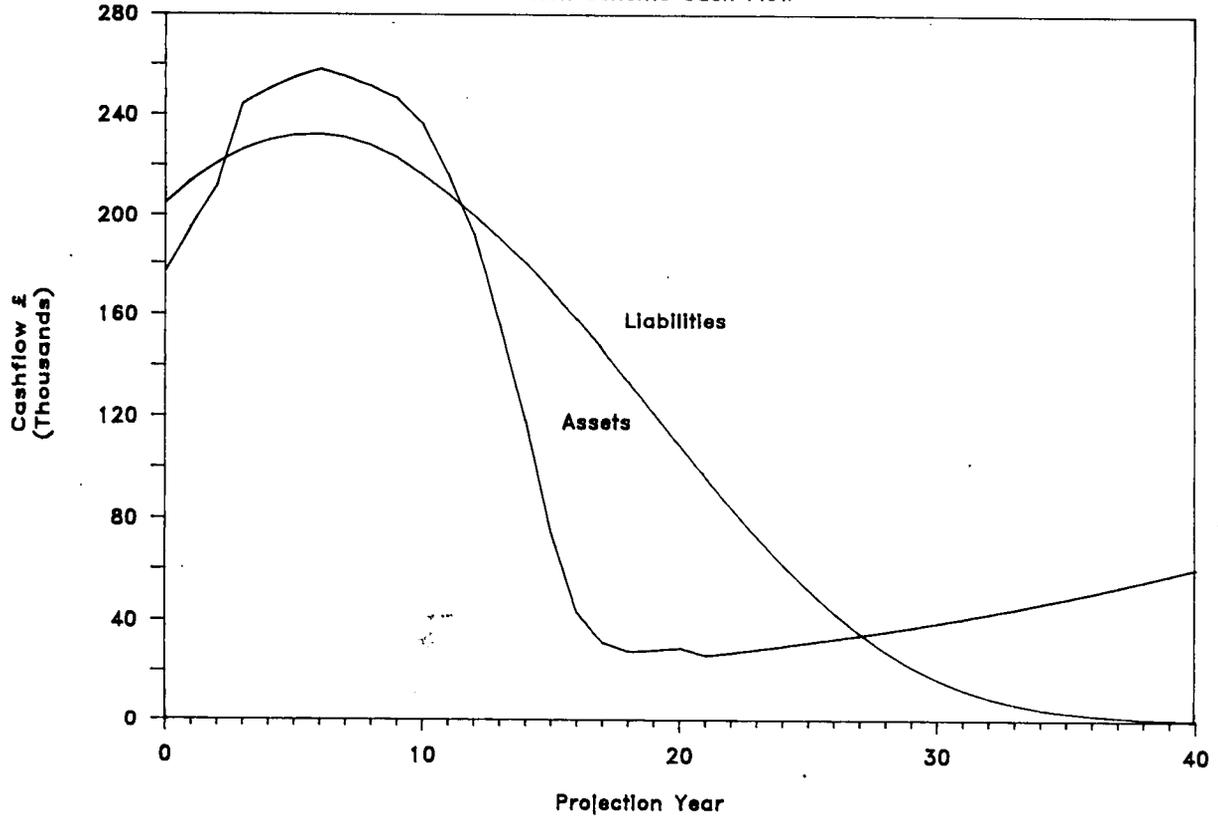


FIGURE 3

ACTUARIES AND ASSETS

Pension Scheme Matched Cash Flow

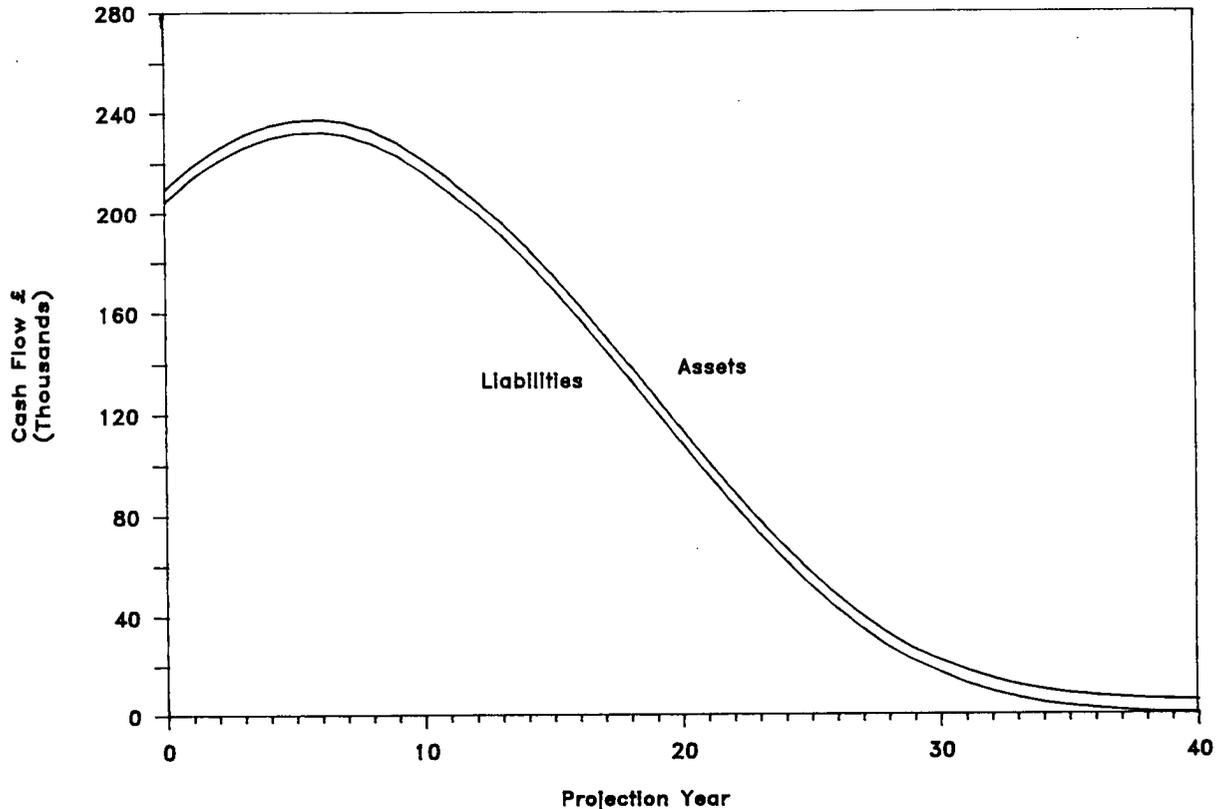


FIGURE 4

ACTUARIES AND ASSETS

Pension Scheme Valuation at 30/9/87

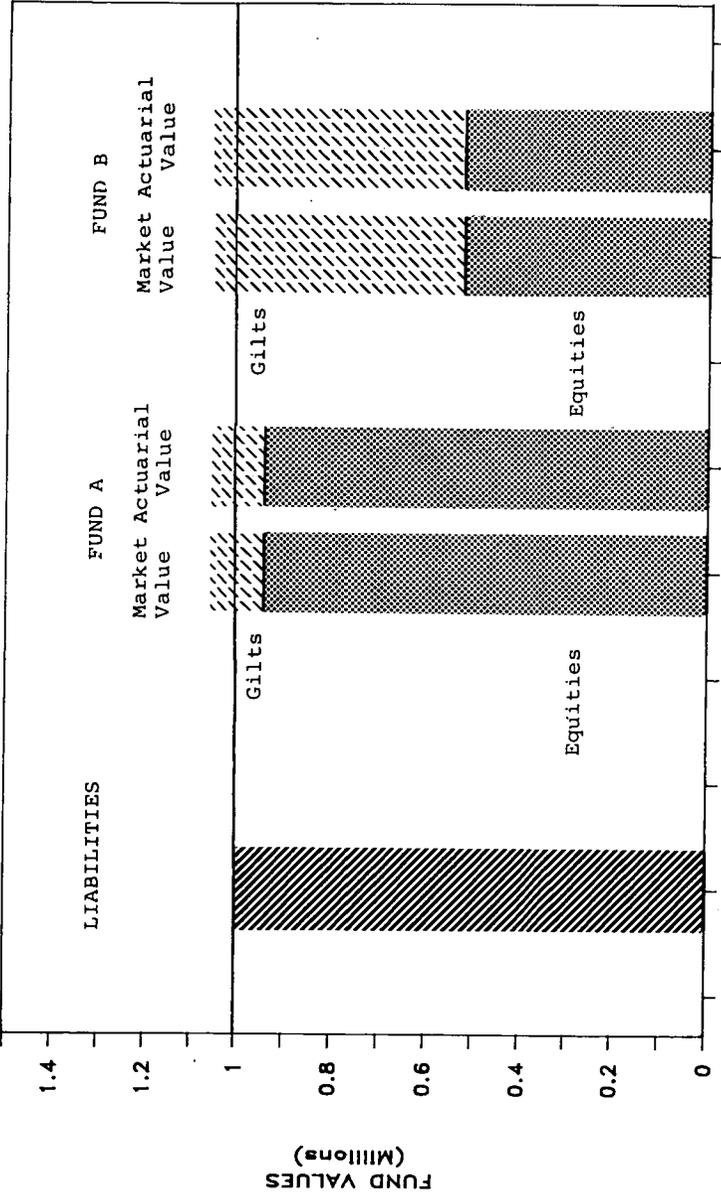


FIGURE 5

ACTUARIES AND ASSETS

Pension Scheme Valuation at 30/12/87

