Choice of pension fund assets and their valuation on a basis consistent with the value placed on the liabilities

by C. J. White (Australia)

Introduction

(1) My purposes in this short paper are:

- to mention briefly some commonly used methods of valuing the assets of Australian superannuation funds, and some difficulties with them, particularly in the light of trends in investment policy and experience;
- to outline what I see as some problems with the traditional deterministic superannuation funding model (which problems are often reflected — with mature funds particularly — in agonising over bases for valuing assets);
- to outline a rather more precisely specified role for the deterministic model, within the theoretical framework of a stochastic model;
- to describe a preferred method of valuing assets under the deterministic model.

An outline only is possible within the constraints of this paper, but I prefer to summarise my overall argument rather than develop part of it in more detail. I am only concerned with the valuation of assets in a long-term projection, the principal objective of which is the fixing of a stable funding rate.

Traditional Methods of Valuing Assets

(2) A one word description of the traditional asset valuation methods used in Australia would be "many". Just a few types of method used are mentioned below with summaries of some of their more obvious individual disadvantages:

Cost Value — many disadvantages (e.g. dependence on activity of investment manager, valuing the same investment differently because of different purchase dates, completely ignoring unrealised appreciation of "equity" assets) have long been recognised; increasing use of "active" rather than "passive" projection methods and assumptions has also made cost values of assets increasingly inappropriate in recent years;

Adjusted Cost Value — this class of methods still has the disadvantages of cost value, though generally less prominently; the most commonly used of the approaches take account of part of the unrealised market appreciation or depreciation (with a certain arbitrariness in the choice of how large a part);

Market Value — the principal problem is variability through time (which can be very significant — see the figures in I (ii) of the Appendix, for example);

Adjusted Market Value — this class of methods generally uses some sort of statistical smoothing (e.g. least-squares fit to logs of stock exchange index values) for shares — difficulties can include sensitivity to the period over which smoothing is carried out, and credibility with the client of the result, if (as has happened) shares are valued at as much as 60% above market value;

Discounted Present Value of Future Net Receipts — this description applies to quite a number of methods which are being used increasingly — the main disadvantages appear to be sensitivity of the results to the assumptions used, and credibility with the client if the result strays significantly from (usually, above) market value.

(3) These types, and indeed all asset valuation methods, can be categorised according to the extent to which they are "retrospective" or "prospective". Cost value-based methods are largely retrospective, while discounted present value methods are largely prospective (though with both types, individual characteristics of the particular method can influence the extent). Market value based methods are more chameleon-like: while at first sight they might seem to be retrospective in character, it can be argued that market value represents the expected discounted present value of future receipts by those prepared to buy at the market price, and hence market value based methods also have a prospective character. The significance of this particular method of categorisation is that, prima facie, retrospective methods do not, to quote the subject of the session, seem to use "a basis consistent with the value placed on the liabilities". In general discounted present value methods are most intellectually satisfying in that they seem best to satisfy this requirement of consistency of the asset and liability valuation methods.

(4) In recent decades the following factors have operated to make the basis of valuation of assets increasingly significant for actuaries advising Australian superannuation funds:

- despite continuing expansion of superannuation coverage, the number of "mature" funds has increased, particularly as employers in formerly labour intensive industries have mechanised and moved some processing overseas to less costly labour markets;
- overall investment returns have become more variable because of increasing proportions of funds invested in equity-type assets, and more volatile interest rate markets (largely the result of the progressive weakening of Government controls).

Problems with the Traditional Funding Model

(5) The traditional deterministic superannuation funding model (which I do not define in detail, but which can loosely be taken to be the long-term funding approach described in most actuarial textbooks) generally has the objective of producing a funding rate which is likely to be stable through time. Typically, the model makes deterministic allowance[1] for decrement rates, or the investment return/salary increase differential, with long-term rather than short-term experience principally in mind. Often the fund's own experience is not adequate for the derivation of a suitable long-term assumption in the foreseeable future in respect of a particular factor, and the actuary will have regard to the experience of other funds (or economic or demographic experience generally) in arriving at his assumptions.

(6) It is the objective of long-term stability in the funding rate which is the rational for most of the assumptions used in the traditional funding model — the investment return/salary increase differential, the promotional salary scale, and the resignation rates, for example. However, when it comes to the data — the membership details in particular — we seem to me to be rather less true to this objective of long-term stability. Generally actuaries would value the actual membership in-force at the date of investigation, even though the employer may have experienced an "abnormal" reduction or increase in his workforce in the period leading up to the investigation. Similarly, actuaries would generally base the valuation on the actual salaries, even though there might have been a large salary settlement just before the date

1 By a deterministic allowance, I mean a single or point estimate in respect of a factor, as opposed to a stochastic allowance (where an estimate is derived from a frequency distribution assumed in respect of the particular factor).

of the investigation[2]. Perhaps it is the feeling that the process should not seem to be completely subjective which dissuades us from "smoothing" everything.

(7) Coming now to the basis of valuation of assets, we generally seem to me to exhibit a mixture of concerns — faithfulness to the data in the assets actually valued, combined with methods and assumptions which (at least in theory) appear to show concern for long-term stability in the basis of valuation employed. I believe that a large part of our problem in arriving at satisfactory bases for valuing assets is due to the conceptual difficulties we have with the role of the traditional funding model. It is a model designed in earlier times, when economic factors were less volatile: I believe its role needs review and redefinition.

A More Precisely Specified Role

(8) Had the superannuation funding model been developed now (with the developments of the last few decades in statistical and financial methods,[3] and computer capability) I doubt it would have been in the form of the traditional deterministic model I have been discussing. It seems much more likely that the model would have been developed along stochastic lines, with frequency distributions being adopted for the major factors which exhibit a significant degree of variability.

(9) It might be argued that, because such a stochastic approach would add very substantially to computational costs, actuaries have had general regard for variability in fixing the deterministic assumptions used under the traditional approach. Further, the increasing use of multiple sets of deterministic assumptions under the traditional approach can be seen as representing a useful (and, from a cost viewpoint, practical) compromise. While I would agree with these arguments as far as they go, I think we need a better theoretical framework against which to judge the appropriateness of the chosen funding rate. What we lack is a developed theoretical framework of stochastic funding models against which to judge the appropriateness of such approaches.

(10) Most of the work which has been done on stochastic models seems to have been in a life insurance environment. Quite a deal of work has been done on stochastic mortality models, and in more recent years, on stochastic investment return models (e.g. the work done in the U.K. on maturity guarantees for investment-linked life insurance contracts). There does not yet appear to have been a great deal of work done on the effect of stochastic allowances for more than one factor, particularly where there is some measure of dependence of one factor on another. Also, much of the work seems to have concentrated on deriving distributions using mathematical rather than simulation methods. With the considerable diversity and complexity of superannuation fund benefit design and deterministic funding models, it would seem virtually essential that any stochastic model employ simulation techniques rather than attempt to manipulate the many mathematical distributions which would be necessary to cope with the usual array of factors considered. It may be that some factors would prove to give rise to relatively little variation, in which event a deterministic approach could be used for them. But it seems certain that there would be a number of factors (e.g. investment returns, inflation and turnover) which would prove to cause significant variation.

(11) The basis for valuing assets in the stochastic model I have in mind would be market value, since the model of the investment returns would be derived from an assumed distribution of market returns. Thus, in the stochastic model at least, the problem of the basis for valuing assets becomes relatively simple.

(12) The funding rate distribution resulting from such a stochastic model would be a very useful tool in assessing the appropriateness of the funding rate on the chosen deterministic model and basis, or in selecting a funding rate from a range of deterministic model results. The funding rate distribution would give an indication of the likelihood that the chosen funding rate would continue to be appropriate in future. If the chosen funding rate at several successive investigations was consistently above or below the mean of the funding rate distributions, it would suggest that the approach used to arrive at that rate contained a systematic bias.

(13) This approach of

(i) a stochastic model (based on actual membership, salaries, market values of assets etc.), leading to a distribution of funding rates,
coupled with
(ii) a deterministic model (based on whatever adjustments to membership, salaries, asset values etc. the actuary judges to be appropriate), leading to a chosen funding rate,

seems to me to provide a much clearer rationale for the actuary's methods and adjustments under (ii). It would enable the actuary to show at successive investigations how his chosen funding method had performed, relative to a distribution of funding rates which, while still dependent on assumptions to a significant degree, is independent of them in a number of difficult areas (in particular, in the value of assets).

(14) I think the approach would also provide a useful tool for explaining what we are doing in a more comprehensible way to trustees, employers, auditors etc. The approach would concentrate attention on the likely future adequacy of the funding rate, rather than on the detailed mechanism by which it has been determined; many of the communication difficulties of asset valuation methods would become of reduced significance.

A Preferred Method of Valuing Assets Under the Deterministic Model

(15) The method of asset valuation suggested here is generally of the "discounted present value of future net receipts" type, and endeavours to link the basis of asset valuation with the assumptions underlying the basis of liability valuation.

(16) The following table represents reasonable allowance for the components of the long-term assumed investment return for the typical Australian private sector fund (see 1(i) of Appendix 1):

Investment Type	*Proportion of Fund*	*Assumed Long-term Return*	*Component in Overall Return*
	%	% p.a.	% p.a.
Shares	40	10[4]	4.0
Property	15	10[5]	1.5
Government	30	5	1.5
Other Fixed interest etc.	15	6.5[6]	1.0
	100		8.0

2 Some Australian actuaries might make allowance for "excess salary increases" if they felt a spate of substantial wage settlements was likely in the short run, but few would allow for anticipated favourable effects in the short run (e.g. probable strong rises in share prices, or restrained wage increases). Others reject the notion of short-term allowances, arguing that wide short-term variations from long-term assumptions are inevitable, and that what is relevant is the level and relativity of the long-term assumptions, not the likely level of short-term variations.

3 Particularly in applied areas such as capital market and portfolio theory.

4 On the basis of the figures for long term bonds and shares (capital plus income) in 2. of Appendix 1, a difference of 5% p.a. between returns on shares and Government securities seems appropriate.

5 There is very little evidence available on returns from property investment by Australian institutional investors; in most cases the estimated market returns depend significantly on the estimated market value of the properties because they were purchased relatively recently, and are likely to be held for many years.

6 Other fixed interest investments have arbitrarily been assumed to give returns on average 1½% p.a. higher than public securities — this seems reasonable from experience in the last couple of decades.

(17) Using the proportions in 16 and the indicators in 2 of Appendix 1, estimates of the historical differentials between investment return and price increases or earnings increases, can be derived as follows:

Period	Estimated Differential Between Investment Return and Price Increases % p.a.	Earnings Increases % p.a.
1916—1940	7.1	5.5
1921—1945	7.5	6.5
1926—1950	5.2	4.0
1931—1955	3.3	2.2
1936—1960	2.8	1.0
1941—1965	2.9	0.6
1946—1970	4.1	1.1
1951—1975	1.9	-1.1
1956—1980	4.4	1.5

(18) These figures show a significantly higher level of "real" investment returns in the periods ending in 1950 or before. The unfavourable experience of the early to middle 1979s is reflected in the 1951-1975 and 1956-1980 figures; the former includes the unfavourable experience of the early 1950s, while the latter includes the favourable experience of the period 1976 to 1980.

(19) In the past there has been a significant margin between rates of increase in prices and in average earnings, the margin in favour of the latter no doubt reflecting productivity gains, the effects of organised labour, etc. Whether this margin will continue in future remains to be seen; some commentators suggest that the future margin might be significantly less than the 3% p.a. which has applied since the end of World War II.

(20) With this background in mind, in choosing the weights to apply to the results from the different periods, I am inclined to

- give least weight to periods up to the Great Depression (because of the low and even negative rates of inflation in that period, which have not been repeated in subsequent periods of depressed economic activity — though admittedly such periods have not been as severe or prolonged as the Great Depression), and
- give greatest weight to periods after World War II, as being the most likely to provide a guide to future long term experience, and including a reasonable blend of good and bad experience.

(21) On this basis, differentials of 3.5% p.a. (price increases) and 1.5% p.a. (earnings increases) seem appropriate. With an assumed long-term investment return of 8% p.a. (para. 16), this would lead to 4.5% p.a. as an assumed long-term rate of price increases, and 6.5% p.a. as an assumed long-term rate of earnings increases.

(22) The discounted present value of assets is determined according to the investment type, and depends on the component in the overall return of 8% p.a. of the particular investment type (from the table in para. 16). Dealing first with fixed interest investments, the Government securities would be discounted at 5% p.a., and other fixed-interest at 6.5% p.a. I would generally assume these securities were held to maturity; there are very few Australian fixed interest securities with outstanding terms of more than 20 years, and the great majority mature within 10 years.

(23) Turning now to shares, future net receipts would be discounted at 10% p.a. The further assumptions which need to be made are:

- the level and rate of growth of dividends, and
- if eventual sale of the shares is to be assumed, the term for which they are held and the level of market values at the time of sale.

(24) There is no satisfactory index of Australian share dividends available (at least for a period of more than a few years). Making what seem to be reasonable adjustments for the deficiencies of the only index available over a suitably long period, a consistent rate of increase in dividends of 4% p.a. emerges. There is remarkably little variation from this rate: consequently (with a well-diversified share portfolio) I assume that the current level of dividends will increase in future at 4% p.a.

(25) In general, I prefer to assume that shares will be sold at some stage, rather than assuming they will be held in perpetuity. Even if the assumptions made (as regards overall share investment returns and dividend growth) prove to be appropriate for superannuation funds as a group, it does not follow that other participants in the capital market will adopt the same view (certainly in the short-term and perhaps — because of tax considerations if for none other — in the long term also). Thus discounting dividends in perpetuity may imply eventual sale on terms which are likely to be significantly out of line with the balance of market opinion. For this reason I prefer to assume sale after a period at a price extrapolated from current levels (after adjustment, as described below).

(26) The method I prefer is as follows:

- adjust current market value according to the ratio
$$\frac{\text{trend line value}}{\text{actual value}}$$
in respect of a relevant share price index (almost always the 'all ordinaries' price index).
- project the adjusted market value to the assumed point of sale at the average growth rate underlying the trend-line, and
- discount the projected market value to a present value at the assumed long-term rate of return on shares.

(27) Appendix 2 shows the progression of monthly average values of the Australian Ordinary Share Price Index (and predecessor indexes) over the 20 years 1962 to 1981, and an exponential trend-line fitted to those values by least squares. 20 years has been chosen as the period over which the trendline is fitted because it becomes increasingly unstable through time if shorter periods are used. As will be seen, the Australian share market has varied very widely; in the recent past the method gives an adjustment factor to be applied to the market value of shares of about 60% as at 30 June 1981, or about 80% as at 31st December 1981. The compound rate of growth underlying the trend-line is about 4% p.a.; hence I have valued the shares assuming a future rate of growth in adjusted market value the same as that assumed in respect of dividends.

(28) Turning now to the period after which the shares are assumed sold, in my view a reasonable approach is to assume sale after a period approximately equal to the outstanding future term of the liabilities. With a typical Australian fund this might be 25 years.

(29) Thus the formula for valuing shares is

Current annual dividends $\times \bar{a}_{25}$

plus

Current market Value $\times$ Adjustment Factor $\times v^{25}$

at a rate of 1.10/1.04 – 1.

(30) Property investment is an area of relatively recent interest for most Australian superannuation funds, and rather less work seems to have been done in developing methods of valuation of property consistent with those outlined above for other investments. As already noted (footnote (5)) good data on property returns are lacking, and will continue to be lacking for some years yet. Consequently I doubt if "sophisticated" methods are appropriate for property at this stage.

(31) In the Australian context, I suggest use of estimated market value for properties in most cases. There is an apparent stability about such values which is absent with shares, and which removes a deal of the usual objection to market values. I say "apparent", because as there is generally a much more limited market in property than in shares, and as the units are much larger, what tends to happen is that when market prices would have otherwise declined or risen to very high levels, trading ceases.

(32) The circumstances where I think other approaches may be appropriate are when property investments are a significant proportion of the total assets, and when considerable detail is available on the individual properties held, including reliable estimates of likely rental and expense levels (with an indication of the broad types of the expenses). In these circumstances a discounted present value approach, on consistent assumptions, may be appropriate. Listed property trusts or units are generally best treated as shares.

(33) When more data on property returns and expenses have been collected, a general method of the discounted present value type may be possible.

APPENDIX 1

1. Result of Survey of 200+ Australian Superannuation Funds

(i) Distribution of Assets by Investment Type

Investment Type	Average Proportion Invested (by Market Value) as at 30.6.81 %
Shares	41.3
Property	17.6
Government	24.9
Other fixed interest, etc.	16.2
	100.0

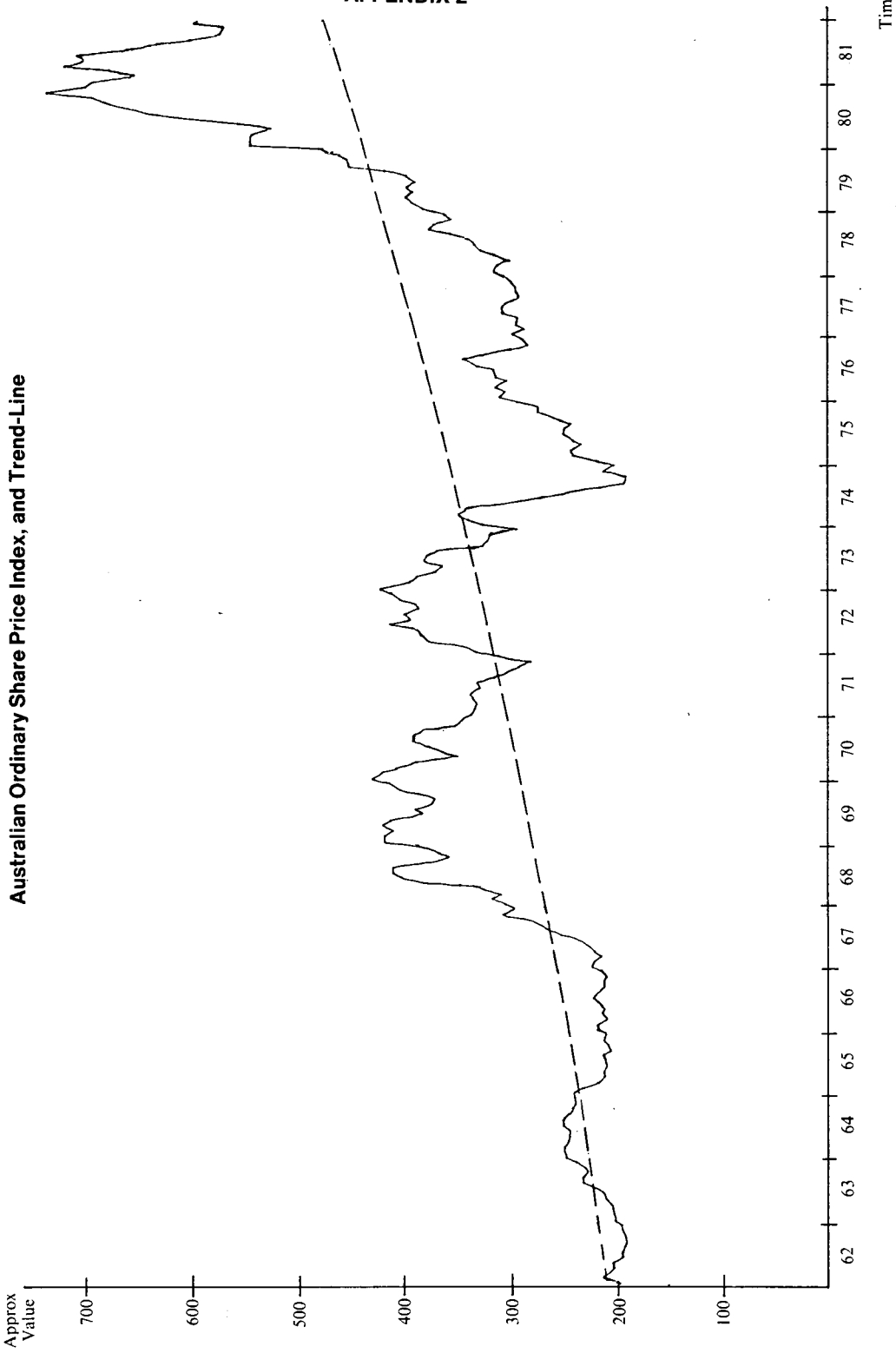
(ii) Time-Weighted Rates of Return Earned

Investment Type	1.7.78 to 30.6.79		1.7.79 to 30.6.80		1.7.80 to 30.6.81	
	Mean	Inter-Quartile range	Mean	Inter-Quartile range	Mean	Inter-Quartile range
	% p.a.	% p.a.	% p.a.	% p.a.	% p.a.	% p.a.
Shares	24.7	21.5 to 26.8	87.4	68.0 to 106.0	22.0	14.8 to 29.0
Property	14.6	12.9 to 16.4	18.7	12.3 to 30.2	24.4	16.8 to 31.3
Government	2.8	1.6 to 4.1	4.5	3.2 to 5.5	7.2	6.3 to 8.4
Other fixed-interest etc.	9.7	8.4 to 11.1	11.9	9.0 to 13.3	14.1	10.6 to 16.4
Overall	13.9	11.8 to 15.4	36.8	29.8 to 45.1	17.2	13.7 to 20.2

2. Investment Return and Inflation Indicators over various 25 Year Periods

Period (1.1 to 31.12)	Prices % p.a.	Average Earnings % p.a.	Shares: Capital only % p.a.	Shares: Capital plus income (approx) % p.a.	Long Term Bonds % p.a.
1916 – 1940	0.9	2.5	1.0	10.2	4.7
1921 – 1945	0.2	1.2	1.5	10.0	4.4
1926 – 1950	1.9	3.1	3.1	9.4	3.8
1931 – 1955	3.9	5.0	3.2	9.8	3.6
1936 – 1960	5.0	6.8	4.4	10.6	3.9
1941 – 1965	4.7	7.0	5.0	10.0	4.1
1946 – 1970	4.8	7.8	6.2	12.0	4.6
1951 – 1975	5.5	8.5	3.6	8.4	5.6
1956 – 1980	5.8	8.7	7.3	12.4	6.9

APPENDIX 2


Australian Ordinary Share Price Index, and Trend-Line
Approx Value
700
600
500
400
300
200
100
62
63
64
65
66
67
68
69
70
71
72
73
74
75
76
77
78
79
80
81
Time