RECORD OF SOCIETY OF ACTUARIES
1978 VOL. 4 NO. 4

VALUATION TECHNIQUES FOR PENSION PLANS

Moderator: DANIEL F. McGINN. Panelists: JAMES L. CLARE, JAMES J. CRYAN, ARNOLD F. SHAPIRO

1. Asset Valuation Methods

   a. Effect of recent market performance and/or new ERISA regulations on acceptable methods.

   b. Problems of communicating actuarial valuation results to non-actuaries.

      i. Recent paper presented to the Canadian Institute of Actuaries

      ii. Objectives of asset valuation methods, especially for communicating to non-actuaries

      iii. Assessment of effectiveness of alternative asset valuation methods in satisfying objectives

2. Use of projections and forecasts

   a. Cash flow demands

   b. Determine liquidity, solvency

   c. Impact of future benefit changes

   d. Effect of experience vs. assumptions

3. Has application of forecasts allowed the actuary to determine short range "best estimate" of future costs different from traditional methods?

4. Treatment of salary scales, turnover assumptions, retirement decrements.

MR. DANIEL F. MCGINN: For many years, actuaries have discussed valuation techniques for pension plans and restricted their deliberations to the long-term actuarial assumptions and cost methods used for establishing employer contributions and/or plan benefit levels. Rarely, in the past have actuaries given a great deal of thought to the interrelationship between the value of plan assets and the value of plan liabilities. With the advent of ERISA and its mandatory requirement to establish a funding policy as a means of developing an investment policy, there has been a virtual revolution in valuation concepts and techniques.

Many actuaries today realize that valuation techniques and long-range assumptions used to fix employer contributions and to establish a funding program may not be at all appropriate for a corporation's near-term planning.

For example, the long-term rate of return may have little or no correlation to the current rate of return on new investments. Likewise, the long-term assumption of future salary changes does not reflect the impact of inflationary salaries on the near-term trend of employer contributions. Consequently, valuation techniques for pension plans are beginning to be viewed as a "family" of techniques - ranging from those used to project long term expectations to those which reflect near-term probable conditions. Actuarial forecasts are now being employed to measure the sensitivity of plan costs and a plan's future funding posture to many dynamic influences; e.g. inflationary salaries, changes in investment rates of return, fluctuating plan asset values and potential industry growth or decline.

Today, we have three actuaries on our panel who will examine the agenda topics from widely different viewpoints. First, we have Mr. Jim Clare, F.S.A., a Partner with the management consulting firm of Peat, Marwick and Partners in Canada. Jim has recently developed an ingenious proposed technique for relating the market valuation of assets to the actuary's investment earnings assumptions in his pension cost calculations. A major thrust of Jim's suggested technique is to improve communications with the publics we serve while developing more stable estimated costs. Also his approach would broaden an actuary's involvement with pension valuations so that he is not so preoccupied with the liability side of pension plan valuations that he gives only superficial attention to the asset side.

Second, we have Mr. Jim Cryan, F.S.A. and a consulting actuary with Buck Consultants in New York. Jim has had considerable experience in actuarial forecasting of both the liability and asset sides of pension plans. Jim's perspective of valuation techniques is oriented to large plans and extensive use of projection systems to evaluate alternate funding packages and to select a package which is likely to generate adequate contributions with acceptable risk coefficients.

Finally, we have Mr. Arnold Shapiro, F.S.A. and Assistant Professor at the Pennsylvania State University. Arnold has performed studies of employee turnover patterns and has completed a summary of the major characteristics of assumptions and methods used in small pension plan valuations. Arnold will balance Jim Cryan's commentaries by explaining how some of these forecast techniques can be effectively applied to small plans.

MR. JAMES L. CLARE: An actuarial valuation concerning the funding of a pension plan is something "to be used", especially for communicating to non-actuaries. This is a particular objective in the choice of a pension fund asset valuation method.

The employer expects to make decisions based upon the actuarial valuation. To do so, the employer needs a maximum of understanding.

True, the assumptions are the exclusive responsibility of the actuary. However, the employer may have useful inputs to contribute. The employer will be better able to offer inputs re the actuarial assumptions if he understands the overall actuarial valuation process.

The actuary adopts the assumptions, but even so it is proper for the employer "to decide the dollars" to be funded. After all, in any given plan year, there is normally no single dollar amount to fund; rather, there is normally a range - from minimum to maximum, with any in-between amount no less acceptable. The minimum contribution must satisfy "pension benefits legislation" in Canada, or ERISA in the United States. The practical maximum usually follows from income tax considerations. Legislation defines the minimum-maximum range. The actuary translates the legislation into "a minimum of at least $X, but not exceeding a maximum of $Y". The final step is determining the amount of the actual funding contribution of $FC (where normally $X≤$FC≤$Y). This final step is the prerogative of the employer.

Therefore, the more an employer understands the actuarial valuation basis, the better.

TESTS

Accordingly, there is a series of tests which should be satisfied by any pension fund asset valuation method.

Some of the leading tests are outlined below, via a series of questions. In each case, the test will be satisfied by any particular pension fund asset valuation method if, for that method, the answer to the question is: "Yes".

1. Employer Concepts

   Is the dollar value assigned to the pension fund assets defined simply, in terms of existing employer concepts, for immediate understanding by the employer?

2. Already Known

   Is the value assigned to the pension fund assets already known to the employer?

3. Computational Basis

   Is there a computational basis for developing the asset value, with an absence of arbitrary "rules of thumb"?

4. Two Shares of Identical Common Stock

   Within the same pension fund at any given valuation date, are two shares of identical common stock, that were acquired at different times, assigned identical values?

5. Internal Consistency

   For any given pension fund and for any particular portfolio at any given valuation date - regardless of the vagaries of the historical timing of the acquisition of the various securities in the portfolio - is there a unique asset value for the portfolio?

6. External Consistency

For two pension fund portfolios of two separate companies which happen to be identical in composition and in total amount, would both funds be assigned identical total asset values?

7. Short-Term Fluctuations - Fixed-Interest Securities

For fixed-interest securities, are short-term fluctuations in market values appropriately smoothed out, so that such short-term fluctuations have no impact on the financial results of the actuarial valuation?

8. Short-Term Flucuations - Common Stocks

For common stocks, are short-term fluctuations in market values appropriately smoothed out, so that such short-term fluctuations have no impact on the financial results of the actuarial valuation?

9. Long-Term Trends

When taking underlying long-term trends into account in the actuarial valuation basis, is there an absence of periodic abrupt adjustments and dislocations? Instead, are there continual re-adjustments?

10. Forward-Looking

Rather than basing itself in the past and moving from there, is the method forward-looking and does it continually move toward the future?

11. Balance Sheet Consistency

Does the method readily achieve consistency between the two sides of the actuarial valuation balance sheet? I.e. is there consistency between (a) the value assigned to the assets, and (b) the present value of future benefits ("the pension liabilities"), without (apparently) arbitrary adjustments being required in the assumptions?

12. Explicit Valuation Basis

Does the method lend itself to use with an "explicit approach? to an actuarial valuation basis, whereby allowance is explicitly made for the impact of possible future inflation (i.e. on future salary increases, on future fund earnings, etc.)?

13. No Manipulations

Is the method free and clear from being manipulated, for example simply by the realization of capital gains (or capital losses)? Similarly, at any given valuation date, is the same value assigned to the assets whether assets are held in cash or are invested?

14. Investment Freedom

If it is desirable to trade assets - with a view to maximizing the profitability of the pension fund - does the method avoid giving rise to a book loss on an asset trade? Does the method thus afford the maximum investment freedom possible?

15. Historical Consistency

For any given pension fund, from valuation to valuation, does the method produce consistent actuarial valuation results, both as to surplus (or deficit), and as to the recommended rate of current service contributions?

16. Understanding by Others

Is the method understood easily by others, including employees, unions, accountants, auditors, the media, consumers, and government regulators - e.g. regulators re both income tax legislation and pension benefits legislation in Canada, and re the SEC and ERISA in the United States?

17. Satisfactory Standardization

The March 1978 "Report on Survey of Pension Plans in Canada", prepared and published by Financial Executives Institute Canada, contained this suggestion (on page 24):

"The FEI pension committeee respectfully submits that there is still room for discussion between the various interested professional disciplines on the principle of standardization of pension plan asset values".

Does the method lend itself to such standardization?

18. Actuarial Cash Flow Projections

It is desirable for the maximum congruence to be "possible" between (a) a traditional actuarial valuation, and (b) an actuarial cash flow projection.

Accordingly, does the method result in the same dollar value being assigned to the pension fund assets under both (a) the traditional actuarial valuation and (b) the actuarial cash flow projection? Also, does the method facilitate realistic amounts of investment income being exhibited, year-by-year, in the actuarial cash flow projection?

Summarizing my recent paper to the "CIA". The 1976 "Pension Plan Survey" of Financial Executives Institute Canada, remarks on the swings in financial results that may occur when pension fund assets are valued at market value. As the market values fluctuate up and down, successive actuarial valuations may reveal first a surplus, next a deficit, then a surplus, and so on.

Not least in an attempt to dampen such swings, various pension fund asset valuation methods are used by actuaries. Appendix A outlines some representative types of such methods.

A further possible method was outlined in my Paper presented to the Canadian Institute of Actuaries ("the CIA") on June 12, 1978, entitled, "Pension Fund Assets at Market Value" (hereafter referred to as, "my CIA Paper").

BASIS OF MY CIA PAPER

In outline, the basis for my CIA Paper is as follows.

Consistency

Increasing emphasis within the CIA is being put on the actuarial principle that there be consistency between the two sides of the balance sheet for a pension fund. That is, that there be consistency between (a) the determination of the value of the assets, and (b) the determination of the present value of future benefits ("the pension liabilities").

Capitalized Approach

One approach to achieving such consistency is the "capitalized approach". First the actuary determines the present value of the benefits. Then, second, using the assumed interest rate, the actuary determines the discounted present value of future receipts from the assets.

That is, future receipts - whether via principal repayments or via interest and dividends - are "capitalized", and the capitalized value found thereby is assigned to the assets.

For actuaries, this capitalized approach is often an attractive theoretical approach for developing "the correct answers", e.g. the correct answer as to the amount of surplus (or deficit), and the correct answer as to the recommended rate of employer current service contribution.

Employer Understanding

However, the employer does not merely want the correct answers to be obtained. The employer also desires that each step in developing such correct answers be as clearly visible - and as simple to understand - as may be practically possible.

In short, the employer wishes to understand - and to understand simply and readily.

The Alternative Approach of my CIA Paper

My CIA Paper presents the alternative approach of starting, first, with the value of the assets, taken at market value. Then, second, in a consistent manner, the present value of the benefits is determined.

The Difference

To repeat, the simple - but important - difference is as follows.

The capitalized approach proceeds thus:

- first, determine the present value of the benefits
- second, determine the corresponding value of the assets.

The alternative approach of my CIA Paper proceeds thus:

- first, determine the value of the assets
- second, determine the corresponding present value of the benefits.

However, as will appear in Section III of this discussion, this simple difference does facilitate understanding by employers.

OUTLINE OF ALTERNATIVE APPROACH

The essence of the alternative approach of my CIA Paper can, very simply, be stated thus:

- "take and use what is already known"

Market Value

Thus, as the first step, use the already-known market value of the assets. Take this market value just as it was known to stand at the valuation date.

Yield Rate A

Suppose, for the moment, those assets are entirely fixed-interest securities. (Other assets will be discussed shortly.) Then, two more items are already-known, namely:

1. the remaining lifetimes of those assets

2. the yield to maturity of those assets, in relation to their valuation date market value.

Use these already-known items, (1) the remaining lifetimes, and (2) the yield to maturity.

Set the first actuarial yield rate assumption accordingly. Call this, "Yield Rate A".

The actuary, in setting Yield Rate A, considers several aspects, including:

- expected investment expenses

- the possibility of forced liquidations of assets, prior to maturity

- a possible fall in future levels of interest rates, and the consequent possibility of assets being paid off early by their issuers, i.e. being paid off before full maturity

- any further appropriate safety margin.

The actuary states in his actuarial valuation report what he has decided in relation to those aspects. There is then a clear link between (I) the items already-known, i.e. the remaining lifetimes of the assets and their gross yield to maturity, and (II) the net Yield Rate A to be assumed at that valuation date.

Common Stocks, etc.

Now consider assets other than bonds and mortgages, i.e. common stocks, real estate, etc.

Surely it is not unreasonable to assume that such other assets will be "at least" as rewarding as bonds and mortgages, over the same time profile. Thus, for example, suppose it is appropriate to assume that the bonds and mortgages will run off steadily over, say 18.7 years and to assume that they will generate a net Yield Rate A equal to 9.3% over such remaining invested lifetimes. Then, surely, it is no less appropriate to make the same assumptions for common stocks and other assets. If not, why does the pension fund hold the other assets?

In other words, in the typical pension fund, surely assuming that all of the assets will generate a net return on Yield Rate A, over the time profile defined by the expected remaining lifetimes of the fixed-interest assets, would be "conservative".

Yield Rate B

The above covers the steps which the actuary takes based on what is already-known.

In the typical pension fund, however, much is not already-known. This applies to the net rate of investment return on all future investments, to be made after the date of the actuarial valuation. Such future investments will consist of:

1. reinvestment of principal repayments, plus

2. investment of interest and dividends, plus

3. investment of fresh contributions from the employer (and from the employees, if applicable).

Let the assumed net rate of investment return on all such future investments be termed "Yield Rate B".

Since Yield Rate B is not already-known, the actuary must set an actuarial assumption for it. This is done using normal actuarial practices.

Where a single percentage rate is to be assumed for Yield Rate B, it necessarily constitutes a long-term assumption. The single assumed value for Yield Rate B will then apply both to the near-term and also to the distant future (perhaps 70 years hence, or even further into the future). Consequently, the actuary will normally assume a value for Yield Rate B that is less than current market interest rate levels (as of September 1978). Also, normal actuarial practice would tend to expect a considerable degree of both stability and continuity, from actuarial valuation to actuarial valuation, in the assumed value for Yield Rate B.

The need for a prudent, responsible, and appropriately conservative approach in making the Yield Rate B assumption is widely appreciated, not least by actuaries, by employers, and by pension supervisory authorities.

FUTURE INFLATION

For brevity, this discussion assumes that the actuary allows for the possible impact of future inflation, "explicitly", including inflation with respect to:

- net rates of future investment returns
- future rates of increases in salaries and wages
- future benefit increases, e.g. during retirement to those pensioners already retired.

Where, instead, the actuary allows for the possible impact of future inflation "implicity", then corresponding revisions are in order, throughout.

SOME FINDINGS OF MY CIA PAPER

Consider a pension fund invested entirely in fixed-interest investments, i.e. bonds and mortgages. Suppose that there is no change in the underlying soundness of any of those investments. Suppose, however, that the market level of interest rates goes up.

That increase in the market level of interest rates certainly reduces the market value of the assets. But, it does more than that. It also increases the yield to maturity on those assets over their remaining expected lifetimes. Provided further that there will be no forced liquidations of assets prior to their expected maturity then, in the actuarial valuation of a pension fund, these two changes exactly cancel each other out.

Thus, as shown in more detail in my CIA Paper, with fixed-interest assets at least, swings in the financial results of successive actuarial valuations of the pension plan, due to fluctuations in market values, are normally unnecessary.

Stemming from this same approach, my CIA Paper also shows that, at least to some degree, fluctuations in the market values of common stocks may perhaps be expected to have a lesser impact on the financial results of successive actuarial valuations.

Using What is Known

The approach of my CIA Paper may be helpful in communicating results to employers, since it uses what is actually known, namely:

I. the market value of the assets; and

II. the yield to maturity on the fixed-interest assets over their expected remaining lifetimes.

Identical Answers

Again in the case of fixed-interest assets at least, the approach presented by my CIA Paper results in answers that are identical to those derived from using a "capitalized" approach to valuing the assets. The answers are the same under both approaches for the surplus (or deficit), and the answers are the same as to the recommended rate of employer current service contributions.

Computational Short-Cuts

Since identically equal actuarial valuation results are obtained using either the capitalized approach, or the approach of my CIA Paper, some computational short-cuts are possible when performing an actuarial valuation using the approach of my CIA Paper.

Thus, the actuary's computer programs may, for example, only accept a single value for the net assumed rate of investment return per each actuarial valuation. This is no obstacle. Precisely computed valuation results are still readily obtainable - simply, easily, and economically - even where the approach of my CIA Paper is taken, including using all three of:

- assets at market value
- Yield Rate A over the expected remaining invested lifetimes of the existing investments
- Yield Rate B for all future investments.

For further details, see my CIA Paper.

The Difference

An actuary may well ask: "If the results of an actuarial valuation will be the same, whether I use the capitalized approach or the approach of your CIA Paper, why should I bother with the latter?"

The difference is that pension fund assets at market value, together with the yield to maturity on these assets over their expected remaining lifetimes, are more readily understood by many employers. That is no small difference. (See, also, Appendix B.)

In what follows, the approach of my CIA Paper - i.e. assets at market value, together with the assumption of both Yield Rate A and Yield Rate B, as outlined above - is described as being the "Market Value with Coordinated Interest Assumptions Method".

CHART 1

DOES THE METHOD SATISFY THE TESTS?

	TESTS	METHODS (per Appendix A)					
		Initial Cost	Automatic Write-Up	Moving-Average	Capitalized	Market Value	Per My CIA Paper
1.	Employer Concepts	Yes	No	No	No	Yes	Yes
2.	Value Already Known	Yes	No	No	No	Yes	Yes
3.	Computational Basis	Yes	No	No	Yes	Yes	Yes
4.	Two Idential Shares	No	No	No	Yes	Yes	Yes
5.	Internal Consistency	No	No	No	Yes	Yes	Yes
6.	External Consistency	No	No	No	Maybe	Yes	Yes
7.	Short-Term - Fixed-Interest	Yes	Yes	Partly	Yes	No	Yes
8.	Short-Term - Common Stocks	Yes	Yes	Partly	Yes	No	Partly
9.	Long-Term Trends	No	No	Yes	Yes	Partly	Yes
10.	Forward-Looking	No	No	Yes	Yes	Partly	Yes
11.	Balance Sheet Consistency	No	No	No	Yes	No	Yes
12.	Explicit Basis	No	Yes	Yes	Yes	Yes	Yes
13.	No Manipulations	No	Yes	Yes	No	Yes	Yes
14.	Investment Freedom	No	Yes	Yes	Yes	Yes	Yes
15.	Historical Consistency	No	Partly	Yes	Yes	No	Yes
16.	Understanding by Others	Yes	No	No	No	Yes	Yes
17.	Satisfactory Standardization	No	No	No	No	No	Yes
18.	Actuarial Cash Flow Projections	No	No	No	No	Yes	Yes

Assessment of effectiveness of alternative pension fund asset valuation methods. Some of the leading tests to be satisfied by pension fund asset valuation methods were outlined via a series of questions previously in this discussion.

A brief outline of some of the various pension fund asset valuation methods appears in Appendix A.

In summary form, the answers of the author as to whether representative methods satisfy the tests - or not - are presented in Chart 1, on the previous page, with further discussion and comment from others warmly welcomed.

SUMMARY COMMENTS

In addition to the assessment presented by Chart 1, the following summary comments may be of interest.

Initial Cost Method

Under the initial cost method, at any given valuation date, two identical shares of common stock in the same fund, acquired at different times, will normally be assigned different values.

Automatic Write-Up Method

To non-actuaries, the automatic write-up asset values will have diverged excessively, e.g. from the market value. To bring them back more in line with emerging trends, there will have to be a more-or-less abrupt adjustment of the values assigned to the assets under this automatic write-up method.

Moving-Average Method

Again, with the moving-average method, have the wieghts to be used in the moving-average computations been developed "scientifically" - or otherwise?

Capitalized Method

The capitalized method for valuing the assets for a pension fund is indeed theoretically attractive to actuaries, in that it leads to "the correct answers", both as to surplus (or deficit) and also as to the recommended rate of employer current service contributions.

However, are the assumptions that have to be made as to the rates of future increases in common stock dividends and in common stock market values sufficiently "scientific" to be credible and acceptable to non-actuaries?

Also, how can non-actuaries accept that different financial results may be produced by the actuarial valuation, depending upon whether cash is converted into assets one day before the valuation date - or one day after?

Consider a bond. Suppose that the bond was acquired previously at par for $100.00, with a 7% coupon, payable semi-annually, and with 15 years to redemption at par. Further suppose that the assumed actuarial valuation interest rate is 5%, and that the prevailing level of market interest rates for bonds such as this happens to be 9%. Then, given the following values, how can non-actuaries readily accept the "capitalized value" being as high as it is?

Par Value:	$100.00
Book Value:	$100.00
Market Value:	$ 85.12
Capitalized Value:	$121.66

Market Value Method

Clearly the market value method, taken by itself alone, results in those needless swings and fluctuations in the financial results of the actuarial valuation of a pension fund that many employees wish to avoid.

Per My CIA Paper - i.e. Market Value with Coordinated Interest Assumptions Method

Under the method described in my CIA Paper - whereby pension fund assets are taken at their market value but there is, at the same time, a consistent and coordinated approach to setting the interest assumptions - the tests appear, with one exception, to be satisfied as well or better than with any other method.

The method of my CIA Paper does indeed eliminate financial impacts from short-term fluctuations of fixed-interest securities, such as bonds and mortgages. It must, however, be recognized that - while this method may well often somewhat reduce and partly mitigate fluctuations in the financial results of actuarial valuations of pension funds arising from short-term fluctuations in common stocks - the method does not entirely eliminate such fluctuations in the financial results. This is a weakness.

As indicated in my CIA Paper, there may perhaps be a tendency for interest rates to be higher when common stock values are lower, and likewise for interest rates to be not so high when common stock values are higher. The application of the method may therefore perhaps - as a general tendency - have a partial dampening effect on fluctuations arising from short-term common stock value fluctuations, but normally no more than a "partial" effect. Moreover, even this much can not be guaranteed.

It may be that, on balance, this weakness can be tolerated for the sake of the other advantages of the method.

Or, another actuary may readily see how better to cope with this weakness, while yet retaining the other advantages of the method itself.

What does anyone suggest?

APPENDIX A

SOME REPRESENTATIVE PENSION FUND ASSET VALUATION METHODS

In the foregoing discussion, the representative asset valuation methods considered are the following.

Initial Cost Method

Under the initial cost method, pension fund assets are shown at their historical cost.

Unrealized gains and losses are not recognized. When securities are sold, gains and losses then realized are recognized at such time.

Automatic Write-Up Method

Under the automatic write-up method, the value of the assets is written up each year, automatically, by a predetermined percentage, less the dollar amounts of net realized gains, and less the dollar amounts of interest and dividends received.

Thus, for example, if the automatic write-up percentage is 8%, and if the combined return from realized capital gains, plus interest, and plus dividends is 7% in any given year, then there is an inherent assumption that the long-term trend of unrealized capital gains expected for the year is 1%.

Moving-Average Method

Under the moving-average method, the initial value assigned to the assets is their cost.

Then, weighted fractions of the unrealized gains and losses are added to (or subtracted from) the base figure, year by year.

Amounts of interest and dividends are accumulated as received.

Capitalized Method

Under the capitalized method, the interest assumption employed in determining the present value of benefits is likewise employed in determining the value to be assigned to the assets.

Using such interest assumption, all expected future receipts from the asset portfolio are discounted to the actuarial valuation date.

For fixed-interest assets, such as bonds and mortgages, the scheduled payments of principal and interest are simply discounted to the actuarial valuation date, using the interest assumption.

For common stocks, there are required, first, forecasts of (i) the future growth rates in the dividends on those stocks (or, alternatively,

the future growth rates in the underlying corporate earnings associated with those common stocks) and (ii) the future market values of those common stocks. Such future anticipated receipts are then discounted to the actuarial valuation date, using the interest assumption.

Market Value Method

Under the market value method, the value assigned to the assets of the pension fund is equal to their market value at the valuation date.

Per My CIA Paper

See above, in Section II of this discussion, for an outline of the method of my CIA Paper, i.e. the "Market Value with Coordinated Interest Assumptions Method".

APPENDIX B

ACTUARIAL PRINCIPLES; FINANCIAL REPORTING; AND CHANGING TIMES

The foregoing discussion does not introduce any new actuarial principles.

Every actuarial principle in the discussion has been developed and explored within the actuarial profession previously - whether recently, or even quite some years ago - whether in Canada, or in other countries.

The author freely acknowledges his extensive indebtedness to other actuaries.

SATISFACTORY RESULTS - A VARIETY OF POSSIBLE APPROACHES

The author would be the first to agree that, in order to achieve sound results that are in conformity with actuarial principles, there is no "one" actuarial approach to adopt.

For example, for achieving actuarial objectives in respect of funding a pension plan, there is no necessity of using the market value of assets in the actuarial valuations. It is quite possible to value the assets in another manner (e.g. at book value, or capitalized value, or moving-average market value, or written-up value, etc.), and still to achieve sound results that meet all actuarial criteria.

Indeed, the dollar results so obtained - as to estimates of surplus (or deficit) and as to recommended current service contributions - may often be identical. For example, the results will be identical whether (a) the actuary begins with the market value of assets and then consistently determines the actuarial present value of the benefits (i.e. using the "Market Value with Coordinated Interest Assumption Method"), or (b) the actuary begins with the actuarial present value of the benefits and then consistently determines the capitalized value of the assets.

There is no vacuum respecting the supply of the requisite actuarial principles. Accordingly, the foregoing discussion has not presented any new actuarial principles; rather, the discussion has examined the practical application of existing, well-established actuarial principles in the real world.

FINANCIAL REPORTING

Until fairly recently, as a general rule corporate financial statements paid little heed to pension costs and unfunded pension liabilities (even though the latter often constitute a sizeable item of "off-balance sheet financing").

The actuary was free to concentrate primarily on the funding of the pension benefits, over time, in a sound manner.

Currently, however, more and more attention is being focussed on the financial reporting of pension costs - not "over time" - but, rather, year-by-year.

The goal appears to be full and fair disclosure of the pension costs attributable to any given financial year.

Accordingly, it appears desirable for the valuation basis for the valuation of the assets of a trusteed pension fund to satisfy a number of objectives, including:

1. being readily understood by all, not least employers, accountants, auditors, and the general public;

2. being insulated from manipulation, i.e. being unaffected by decisions as to whether (or not) to realize capital appreciation;

3. assigning identical individual security values to two identical securities acquired at different times (e.g. two shares of IBM stock, where one was purchased twenty years ago and the other was purchased last month and where both are identical in all respects, would be assigned identical values); and

4. assigning identical total portfolio values to two identical portfolios, regardless of whether one portfolio was built up slowly over thirty years or the other was acquired quickly in the last year or so.

Surely those four objectives (amongst others) all need to be satisfied to achieve the kind of accounting and reporting now being striven for by the interested parties.

Surely those four objectives will not always be attained if the assets are valued at some kind of "adjusted" values.

But, surely those four objectives will indeed be attained if the assets are always valued at their market values.

CHANGING TIMES

As a rather sweeping generalization, perhaps, whereas it used to be a case of employers saying: - "Let's take the actuary's results - with no questions asked", nowadays it more and more appears to be a case of employers saying instead: - "Let's see for ourselves, at least as a broad overview, what the actuary has done - where he has started, what roads he has travelled, and what destination he has reached, in relation to the real world".

Any employer wishing to achieve such a broad overview appears to have two choices. As one choice, the employer could take the time to study actuarial terminology, principles, concepts, practices, and procedures, to the point of being able to understand sufficiently any results that may be presented in technical actuarial terms. ("If" the employer has the time and the interest to do so, of course).

As the other choice, the actuary - while completely retaining his actuarial soundness and fully discharging his professional responsibilities concerning the future - can "translate" his actuarial work into business language and couple that with enough accompanying common sense "demonstrations", so that the actuarial results are more readily assimilable by the employer.

The foregoing discussion has been an attempt to present one such "translation" coupled with a few relevant "demonstrations".

MR. JAMES J.CRYAN: In recent years forecasting and planning using computer models has become an integral part of corporate life. Models using simulation techniques have proved to be a valuable tool in analyzing questions that do not lend themselves to easy solutions because of complexity, uncertainty, or both.

Actuaries have been in the forecasting and planning business for many years. In fact, building and using models is the very essence of what actuaries do. An actuarial valuation consists of the construction of a model of a retirement program and a study of its expected operation.

Projection Techniques

The modeling process involves the projection of all pertinent items for the situation being studied. For a pension plan, projections of the following items are usually required.

- active and retired groups
- plan provisions (future improvements currently contemplated and improvements expected in the future due to the impact of inflation and collective bargaining)

- contributions to the plan
- payouts from the plan
- investment returns on plan assets

In projecting investment returns the system may have the capability of simulating most likely and potential investment performance. Under this approach, the simulated results are probabilistically ranked and then attention is focused on the results for various percentiles.

The appeal of the modeling technique is:

- its ability to bring to life the subject under study. The traditional actuarial valuation is a static snapshot which provides information about current conditions and indications about future trends. Dynamic projections provide a moving picture of what the future will bring under different scenarios. They reveal what can happen and when.

- its focus is on key items expressed in terms familiar to management, instead of actuarial jargon. Of necessity, the traditional valuation involves actuarial techniques designed to convert the expected future flow of events to present values. This complicates the translation of results into management terms and obscures the year to year flows which management needs to see. A set of favorable results in earlier years followed by unfavorable results in later years may have the same present value as if the order were reversed, but the implications for management might be drastically different. Projections illustrate the flow of events and reveal the financial results of different scenarios. They show benefits, contributions and assets as a percent of payroll, and measurements of a plan's liabilities compared with items such as plan assets and the company's net worth.

- its ability to provide information about a subject too complicated to be completely analyzed using conventional methods. For example, the development of an investment policy involves balancing opportunities and risks. Traditional methods focus on the expected rate of return and do not evaluate the effect of the possible range of investment returns. Using the simulation technique, the potential risks can be shown at the same time the potential rewards are illustrated.

FINANCIAL POLICIES

Pension financial decisions are concerned with funding policy and investment policy. Funding policy involves a determination of how much to contribute and when to contribute. Investment policy determines what to invest in, in the long-run.

Companies usually undertake financial policy studies because they feel some change should be made in the funding or investment area. In some cases, however, a company that is satisfied with its funding and investment policies conducts a financial policy study to satisfy fiduciary responsibilities. The purpose of such a study is to confirm that present policies are appropriate.

Experience has shown that there are important interrelationships between funding policy and investment policy. For example, a desired level of conservatism might be better achieved by increasing contributions and investing in more volatile assets than by continuing the current funding level and investing in a more conservative fashion.

Because of the interrelationships it is usually desirable to consider both funding and investment policies at the same time. However, if a company wants to consider changing only one of the policies, this can certainly be done, but one must constantly be aware of the impact changing one of the policies has on the other.

A financial policy study normally consists of three steps. The first step is to determine the implications of present policies. The second step is to set financial goals. The third step is to establish policies designed to achieve the goals. In other words, you find out where you are, where you want to be, and how to get there.

In the first step, determining where present policies are headed, we use the plan model to illustrate the possible course of future developments. To do this one must:

- determine the company's obligation to pay benefits (if expenses are paid from the fund, benefits plus expenses should be looked at). Fund assets increase when company contributions plus the investment return exceed benefit payouts. Thus, the first step is to project benefit payouts as a percent of payroll.

- determine contributions and investment returns under the company's present policies.

- chart the course of future asset growth using the data described above.

- compute key ratios that can be used as benchmarks to measure funding progress. One is the progress of the ratio of plan assets to accrued liabilities, which is commonly called the funding ratio. Others are the ratios of unfunded liability amounts to corporate net worth, for example.

After studying the implications of present policies, financial goals are set. An example of a financial goal would be to build plan assets at least equal to the liabilities for vested benefits within 15 years. Another example would be to keep unfunded liabilities for vested benefits from exceeding 10% of the company's net worth. For many

companies determining the timing of pension expenses equitably from a stockholder's viewpoint is an important financial goal. The goals for a particular organization reflect both its philosophy and its resources.

The financial goals are then achieved by developing a funding policy and an investment policy.

FUNDING POLICY

As was mentioned previously, funding policy is concerned with how much to contribute and when to contribute.

By studying the ability of the present funding policy to achieve the established financial goals one can see if contributions should be increased, or if a decrease is possible. Then, working within the boundaries of minimum statutory contributions and maximum tax deductible contributions, a funding policy involves the selection of an actuarial cost method, actuarial assumptions, and a program for amortizing unfunded liabilities which drive the plan assets toward the financial goals.

To an actuary the real worth of projections lies in developing a funding policy that will achieve the company's financial goals while enabling the actuary to satisfy himself that he is fulfilling his professional responsibilities.

INVESTMENT POLICY

As was mentioned previously, investment policy deals with what to invest in, in the long-run (categories of assets rather than individual investments).

Setting investment policy involves balancing potential risks and rewards. To do this, one must take into account the ability of the plan and the company to assume risk (risk in the sense of possibly adverse investment performance). The level of plan assets relative to the accrued liability has vital bearing on the ability to absorb risk.

This fact leads to concern over projection studies which are being made by organizations where no actuaries seem to be involved. In some cases the actuarial liability projections seem to be so deficient that it is questionable that sound investment policy decisions can be made. In the long run the actuarial profession may be damaged.

DEMOGRAPHIC AND ECONOMIC CHANGES

The traditional actuarial valuation does not adequately measure the impact of demographic and economic changes.

For example, what happens if the size of the work force increases or decreases, or if the type of worker the company employes changes, perhaps due to mechanization? What happens if employees work to age 70 instead of retiring at the age at which they now retire? The projection technique can provide more information regarding questions of this nature than the traditional valuation approach.

There is much concern today about the impact of continued high levels of inflation. In recent years most companies have seen costs skyrocket and they are wondering what will happen if recent trends continue.

Using projections, the effect of different levels of inflation can be illustrated. It is very desirable that the system have the ability to use a different rate of inflation for the year-to-year projections of payrolls and plan assets than is used in the actuarial valuation to determine plan costs each year. In other words, we can assume the regular valuation inflation assumption will continue to be used and then show what would happen if the rate of inflation actually experienced exceeds the rate assumed in the regular valuation. In fact, it is highly desirable that the system incorporate the ability to handle two complete sets of actuarial assumptions.

When focusing on inflation one must look at pension costs and liabilities related to other items adjusted for inflation. For example, it is interesting to look at the possible magnitude of pension costs in dollars, but costs expressed as percentages of payroll represent a more meaningful measure of the true burden of contributions in an inflationary environment.

It is interesting to note that we have often found the ultimate impact of certain demographic and economic changes to be quite different from what one would initially expect. For example, a high rate of inflation can actually improve the pension financial picture. Unless benefits are scheduled to increase with inflation after retirement, higher levels of inflation open the door to passing more of the burden to retired members. Similarly postulation of higher rates of real wage increase is not conservative since it is accepted doctrine that this component is not granted to retired employees.

BENEFIT CHANGES

The modeling technique can be used to determine the long range impact of benefit changes. Both the desirability of a change and the timing of a change can be studied.

For example, a change in a plan's average retirement age might be analyzed. If the age at which an employee may retire with full benefits is decreased, and if employees utilize the new provision, there is an impact on plan costs and the size and composition of the work force. A projection study can analyze both aspects.

One particularly interesting application of the modeling technique is to study the impact of granting cost-of-living (COL) increases after retirement. The long range cost of COL increases can be far more than many companies realize. The extent to which a company grants COL increases may well be the most important single factor in determining the ultimate cost of a retirement program.

MR. ARNOLD F. SHAPIRO: Since ERISA there has been considerable discussion regarding the actuarial asset value to be used for small pension plan valuations. While it is clear that market values have to be recognized, it has

been suggested that unadjusted market value would not be used to any great extent because of the considerable likelihood of fluctuations. Table 1, which is based on the findings of a recent study of small pension plan valuations,[1] provides some indication of a tendency in this regard.

Contrary to expectations, unadjusted market value was the most common asset valuation method in the reports studied. This was true of both the combination plans and the fully trusteed plans. In both instances unadjusted market value was used in over 76 percent of the valuations.

The approaches to adjusting market value were quite varied. Among the adjustments used were: a 5-year moving average beginning with the first post-ERISA year of experience; the average of market value and book value; the average of market value and cost; the previous years market value plus 25 percent of the appreciation or depreciation in market value; and book value, subject to a minimum of 75 percent of market value and a maximum of 125 percent of market value.

TABLE 1
ASSET VALUATION METHOD

Plan Size	Unadjusted Market Value	Other	Total
1-5	24	6	30
6-10	20	6	26
11-15	5	1	6
16-20	2	3	5
Total	51	16	67

Pre-Retirement Interest Rate Assumptions

The pre-retirement interest rate assumptions which were used are shown in Table 2. The rates were concentrated between 5 and 6 percent, with almost 42 percent using a 5 percent rate, almost 15 percent using a 5 1/2 percent rate, and almost 33 percent using a 6 percent rate. Only 11 percent of the reports had interest rates which fell outside the 5 to 6 percent interval.

---

[1] The study was based on a sample of actuarial reports attached to the Form 5500C, Schedule B, which where sent to the Department of Labor during the period June 1976 to May 1977. Since only small plans were to be considered, the study was restricted to plans of twenty active participants and less. In all, 181 valuations of 91 actuaries were reviewed and classified. Of these, 35 contained disclaimers and were excluded from most of the analysis. No attempt was made to randomize the sample other than to make certain that each group of 100 enrolled actuaries, based on ascending enrolled actuary numbers, was represented.

TABLE 2
PRE-RETIREMENT INTEREST RATE ASSUMPTIONS

Plan Size	Interest Rate (%) 3.5	4	4.5	5	5.5	6	6.5	Total
1-5	0	2	2	16	8	16	2	46
6-10	1	0	2	17	4	11	0	35
11-15	0	0	1	5	3	5	0	14
16-20	0	1	0	4	0	1	0	6
Total	1	3	5	42	15	33	2	101

The average interest rate, disregarding plan size categories, was 5.4 percent,[2] while for the four size categories the average interest rates were 5.4 percent, 5.3 percent, 5.4 percent and 5.0 percent, respectively.

Use of Projections and Forecasts

The notion of pension cost projections, of course, is not a new one. Indeed, authors since the turn of the century were advocating the use of pension cost projections to monitor the expected cash flow of a pension plan. Invariably, however, projections are generally based on large plan parameters, with the result that small plan pension cost projections are mentioned only sparsely both in the literature and in sessions such as this.

What, then, is the state of the art in small plan projections. The most common projection currently used is associated with the fully trusteed plan, and generally involves the projected cash flow of the trust fund. Among the factors considered are the accumulation of trust fund assets, the debits from the trust as a result of retirements and credits to the trust as the result of contributions.

Generally, small plan projections rely on the assumption that the only sources of decrement is retirement. This is not surprising since one is confronted with dealing with partial participants. If, for example, the probability of mortality at a given age is 5 percent, and there is only one participant at that age, the expected number of participants one year hence, at one age older, is .95. Conceptually, it is difficult to deal with .95 of a participant. Largely for this reason, projections associated with small plans seldom involve more than interest and salary scale.

Insofar as future participants are concerned, small plan projections invariably are based on the assumption that the only future entrants to the plan are current employees who have not yet met the participation requirements. As a general rule, no provision is made for future employees.

It is clear that this type of projection is quite elementary by large plan standards. Not only are the full spectrum of assumptions not tested, but an essential ingredient of the projection technique is missing, the open group characteristic.

- - - - - - - - - - - -

[2] This percentage has been adjusted to eliminate double counting.

The Expected Active Lifetime Approach

At Penn State we have been experimenting with various methods for introducing open group techniques into small plan projections. The approach which we have found to be the most promising is what might be referred to as the expected active lifetime approach. Under this approach, each participant is assigned an expected active lifetime. For the plan sponsors it will generally be the duration until their normal retirement age, or their early retirement age, depending on their retirement philosophy. The expected active lifetime of other key individuals may be until their normal retirement age, or, if they are highly mobile, some shorter duration. The rank and file employees can generally be classified into relatively broad groups. One scenario might be that new employees aged 24 or younger are expected to quit after a couple of years, while new employees aged 25 or older generally remain for an average of 5 years.

The Replacement of Terminated Participants

In order to implement the projection technique, it is necessary to come to grips with the way that terminated participants will be replaced. There seem to be two reasonable possibilities for small plans. The first would involve the replacement of a terminated participant with a new employee who had all characteristics in common with the terminated participant except that the attained age was the hiring age and the starting salary was the starting salary of the terminated participant, the latter adjusted as necessary for changes in the general level of salaries. The rationale in this case is that the terminating participant will be replaced with a "fresh young face." Another possibility, however, would be to have the terminating participant replaced with another employee of the same attained age. The rationale in this case is that the terminating participant would be replaced with a person of like experience. Hence, not only would the attained age be the same as the person who terminated, but the salary would also be the same.

The problem of choosing which of these individuals would be the replacement is, of course, a critical one. One approach, which could be used to develop minimum and maximum cost guidelines, would be to use, alternatively, the most optimistic and most conservative assumptions. If the assumption is made that the new employee enters at a younger age and lower salary, the pension costs likely would be less. On the other hand, if the new employee is at the same attained age and salary, the pension costs should be somewhat higher.

A more sophisticated approach would be to assign some a priori probability of replacement with either a new or experienced worker. For a given type of employee, for example, there might be a twenty percent chance of being replaced by an experienced person of roughly the same age. At the projected termination of a participant a random number would be consulted. If this number falls within a given range the replacement employee would be assumed to be at the hiring age; otherwise, the replacement employee would be assumed to be at the attained age. While this process may seem somewhat contrived, it does provide a vehicle for introducing the subjective judgement of the plan sponsor into the pension population projection.

Of course, each simulation would likely result in a different progression of the plan population and, as a result, a number of such simulations would be required in order to develop a spectrum of potential costs. The optimum number of such simulations would, initially at least, have to be ascertained.

"BEST ESTIMATES"

The question typically addressed to pension plan data is "what would happen if currently appropriate decrement and economic factors continued?" This question is the basis of most current actuarial pension plan valuation techniques. While the impetus for using this scenario comes from many sources, not the least of which are the regulatory bodies, it is important that we recognize that this approach may be only marginally relevant, and that we are likely to be confronted with demands for more relevant and better pension cost forecasts.

With this in mind, we currently find ourselves in the era of pension cost projections. Note, however, that I say projections rather than forecasts. Projections are the numerical consequence of the assumptions chosen. The numbers that are obtained are conditional on the assumptions being fulfilled: if entry and termination rates move in a certain fashion the total impact on costs will be such and such. The cost projections are correct beyond any test against a subsequent valuation; in fact they can be incorrect only in the trivial sense that the actuary made an arithmetic error that prevented his final numbers from being consistent with his initial assumptions.

The typical consumer of an actuarial valuation, however, is not an actuary, and what he is after are predictions of what will actually happen in the future. As a consequence, the valuation presented as an innocent, indeed totalogical, projection by the actuary is accepted in some sense as a forecast of the future. The bridge between these two points of view, the actuary who is right if his assumptions hold and the consumer who relies on his prediction has to be the frontier for which we strive.

What might be the nature of the frontier, and in what direction might we ultimately be headed? If I may venture an opinion, it is that the deterministic models upon which most, if not all, of our technology is based, will be superseded by stochastic models.

Consider the probability that the projected cost will be at least as great as the actual cost, given that the exact probabilities of decrement are known. When one develops this probability, one is confronted with a thought provoking observation. There is, roughly speaking, a fifty-fifty chance that the projected cost for a given generation of retirees will be inadequate to fund the actual cost. This evidence leads one to inquire whether expected cost is sufficient information from which to fund a pension plan. It seems feasible that the day ultimately will come when the actuary is expected to provide not only an estimate of projected pension costs, but also a statement of his confidence in that estimate, and the relevance of that estimate to the future solvency of a given pension plan.

Salary Scales

The contention that salary scales are appropriate for small plans has required many actuaries to rethink their approach to valuations. Nonetheless,

most actuaries included in the study mentioned previously apparently have concluded that it is not necessary to incorporate salary scales into the valuation as long as their probable impact is taken into account. The most common method of disclosure in this instance was simply to indicate that no salary projection was used, but that one is "implicit in the interest rate." In some instances, an additional statement was included to the effect that if salaries increase more than expected, costs may increase more than proportionally.

On the other hand, a number of valuations did include a salary scale. These were of two types. The first used a level percentage assumption, that is, the salary scale was assumed to be an annual increase percentage which is independent of either age or service. The second type depended on inhouse or published tables or some assumption other than a level percentage assumption. Table 3 gives the distribution of salary scales that were used.

The most common level percentage assumption was that salaries would increase at the rate of 3 percent per year, being the assumption used in 35 percent of the instances.[3] A 4 percent assumption was used in 24 percent of the cases. In only one of the twenty-two cases where a level percentage assumption was used was it above 4 1/2 percent.[4]

TABLE 3
SALARY SCALES

Plan Size	Salary Scale (%) 1.5	2	2.5	3	3.5	4	4.5	5	5.5	6	Other	Total
1-5	0	1	1	5	2	0	1	0	0	1	0	11
6-10	0	1	0	2	0	4	0	0	0	0	3	10
11-15	0	0	0	2	0	1	0	0	0	0	2	5
16-20	1	0	0	0	0	0	0	0	0	0	2	3
Total	1	2	1	9	2	5	1	0	0	1	7	29

The column labeled "other" includes Actuary's Pension Handbook tables, S-4 in one case and S-5 in another; a salary scale defined as a 3 percent to age 55 and 1.5 percent thereafter, to retirement; one instance when separate male and female tables were used; and non-geometric inhouse salary tables.

Termination Rates

The inclusion of vesting provisions in ERISA has brought to the forefront the question of the cost of vesting, and it has been suggested that termination rates are being used to a larger extent in small plans. While

---

[3] This percentage and the following have been adjusted to eliminate double counting.

[4] In this instance a 6 percent salary scale was used with a 5 percent preretirement interest rate assumption in the valuation of a pension plan with a single participant.

this may be the case, termination rates were used in only 19 percent of the reports reviewed.

Table 4 was tabulated in an attempt to discern any tendency towards the use of particular turnover tables. Over 60 percent of the tables used came from the Actuary's Pension Handbook, with Turnover Tables T-1, T-2 and T-3 being cited most often. Included in this category is one report where Table T-3 was used for males and Table T-5 was used for females and another where Table T-5 was used for males and Table T-7 was used for females. The column labelled "Other" indicates the use of inhouse tables.

TABLE 4
TERMINATION RATES

Source		Total
Actuary's Pension Handbook tables		
T-1	3	
T-2	3	
T-3	4	
T-6	1	
T-3 for males, T-5 for females	1	
T-5 for males, T-7 for females	1	13
Other		8
Total		21

As expected, in none of the cases studied were select tables used and most actuaries apparently use the same table for both sexes. Furthermore, there appeared generally to be no attempt at involving the plan sponsor in the selection of appropriate turnover tables.