

**TRANSACTIONS OF SOCIETY OF ACTUARIES
1980 REPORTS VOL. 6 NO. 3**

INVESTMENT POLICIES OF LIFE INSURANCE COMPANIES

*Moderator: MALCOLM R. REYNOLDS. Panelists: JAMES A. TILLEY,
RONALD KARP, GARY ROLLE**

1. Investment Portfolio Issues - Ordinary Insurance vs. Pension Plans
 - a. Selection considerations
 - b. Factors affecting composition of portfolio
 - c. Investment philosophy during high inflation

2. Social Aspects of Investment Practices
 - a. Responsibility to policyholder/stockholder and to plan sponsors/beneficiaries
 - b. Responsibility to society

3. Relationship of Investment Policy to Pricing
 - a. Retired lives reserves
 - b. Single premium annuities
 - (1) Immediate
 - (2) Deferred
 - c. Guaranteed investment contracts
 - d. Deposit term
 - e. Policy loans
 - f. Other

4. Analysis of Investment Results
 - a. How are they defined?
 - b. What standards of measurement should be used?

*Mr. Rolle, not a member of the Society, is a Vice President with the Occidental Life Insurance Company.

Due to technical difficulties the first several minutes of the session were not recorded. In summary the matters dealt with were:

1. The moderator, Malcolm Reynolds, introduced the topic and each of the panelists.
2. David Promislow briefly summarized the contents of his paper. A New Approach to the Theory of Interest.

The following transcript begins with the prepared remarks of James Tilley.

MR. JAMES A. TILLEY: My remarks will deal generally with the relationship between investment strategy and product design, and specifically with my paper "The Matching of Assets and Liabilities" about this subject.

The events in the United States' financial world since October 6, 1979 have generated considerable interest in immunization theory and practice where little had existed before. Any chart of interest rates over the last year illustrates vividly how violent rates can fluctuate. There are two types of interest rate risk against which immunization attempts to protect.

1. Reinvestment Risk - The risk that interest rates will fall and that funds will have to be reinvested at prevailing new-money rates less than the rates assumed in pricing the product.
2. Liquidation Risk - The risk that interest rates will rise and that funds will have to be liquidated at a capital loss in order to meet contractual payments.

A fund is exposed to reinvestment or liquidation risk, respectively, when it is in a net cash inflow or outflow position.

Generally it is not understood why there is ever any significant liquidation risk. In the first quarter of this year, many insurers had to draw on bank lines of credit or issue commercial paper in order to provide sufficient funds to meet commitment takedowns. These actions were in lieu of or supplemental to actual liquidations of fixed-income assets at depressed prices, and are a dramatic example of liquidation risk. The two primary sources of the short term cash flow deficiency were increased policy loan activity and sharply reduced inflow of group pension money.

Liquidation risk is important, however, even when an insurer has overall net positive corporate cash flow. At stake is equity between the various product lines and perhaps between the various generations within a product line. Over a given period, some lines or blocks of business may have net cash outflow. An equitable allocation of investment income suggests that these lines borrow funds at the prevailing new money rate from those lines having a net cash inflow. Exposure to the necessity of such borrowing is equivalent to liquidation risk.

Reinvestment risk and liquidation risk are exacerbated by investment anti-selection against the insurer. Increased inflow of funds occurs at times of falling rates when corporate borrowers call bonds or prepay mortgages and when pension clients increase deposits under contracts with an interest guarantee that applies to all money deposited during a specified period. Increased outflow of funds occurs at times of rising rates when policyholders borrow more heavily against the cash values of their policies or withdraw contract funds at book values or at market values computed at inadequate asset liquidation charges.

Any attempt to match assets and liabilities begins with identification of items of cash flow. It is common practice to separate cash flow into two components: that originating from investments (interest and principal payments) and that associated with insurance operations (premiums and contributions as inflow items and expenses, benefits, dividends, and taxes as outflow items). It is convenient to segregate investment cash flow further into interest and principal from the "initial" portfolio - namely, all existing assets and all assets purchased with currently investable funds - and interest and principal from investments to be made in future years. The amount of surplus at specified points in time can be calculated by an investment generation method that takes account of the amount and incidence of all cash flow. The asset-liability matching problem is to determine how to allocate currently investable funds among asset classes and within classes by maturity, credit risk and other characteristics so that the fund is solvent at desired points in time under adverse new money interest rate scenarios.

Adverse scenarios are those where interest rates are low or high, respectively, when there is substantial net inflow or outflow of funds. It is not the interest rate scenarios themselves which are necessarily adverse - it is the interplay between interest rate movements and the net cash flow position of the fund. The cash flow requirements of various products differ as to incidence and amount. Thus, interest rate scenarios that are adverse for one product may not be adverse for another. If each product is to be priced on a self-supporting basis, separate investment strategies are needed to address the respective adverse scenarios. However, if the products are to be priced on a pooled basis, it is possible to play off the strengths of one against the weakness of the other to arrive at a more flexible investment strategy for the composite product portfolio.

Any pattern of future new money interest rates can be used in the asset-liability matching model described in my paper. This contrasts with conventional immunization theory which examines only scenarios in which interest rates change immediately from the current level to some new level and then remain there. Immunity to further changes can be ensured only if the maturity structure of the asset portfolio is adjusted after each significant change in the level of interest rates (and as time passes whether or not rates change). Unless there is substantial cash flow available for investment after the shift in the level of rates, the adjustment in the composition of the portfolio will require the sale of some assets and the purchase of others. However, the portfolios of most insurance companies are heavily weighted with private placements that cannot be traded because they have no secondary market. Once purchased, these assets are tucked away until maturity. Thus, maintaining an immunized position according to the

conventional theory may not be easy. The model described in my paper partially mitigates this difficulty by considering at the outset many different patterns of future new money rates. Generally, this results in smaller adjustments to maintain an immunized position.

The balance of my prepared remarks will deal with the practical mechanics of applying the asset-liability matching model to guaranteed investment contracts. The model brings together three vital activities.

1. Product Pricing - how to set the interest guarantee and asset liquidation charges.
2. Investment Strategy - how to invest funds backing the contract.
3. Surplus Planning - how to quantify interest rate risk and to achieve compatible product design and investment strategy to cover this risk and thus prevent impaired surplus.

Active cooperation of financial officers and product actuaries is essential to the successful performance of these activities.

The process begins by having financial officers define representative fixed-income instruments such as bullet bonds, sinking-fund bonds, farm and commercial mortgages, etc. Several different instruments within each broad category should be selected to cover the range of vehicles in which the company can invest. Investment personnel will specify the principal and interest payment pattern for each of the representative instruments. They should also specify the scale of call premiums and prepayment penalties and the expected level of calls and prepayments as a function of the prevailing new money interest rate. Actuaries responsible for product design will construct a pricing model of the product that details the amount and incidence of all liability cash inflow and outflow such as deposits, contractual payments, asset-liquidation charges, expenses, and taxes. Investment and actuarial personnel will jointly determine several adverse scenarios of future new money rates that define the extent of interest rate risk against which the product is to be protected.

Given a product design, the asset-liability matching model determines how currently investable funds should be allocated among the representative investment vehicles to ensure non-negative surplus at specified points in time. The various new money scenarios are not assigned weights. The fund must be solvent under each one separately and the only investment strategies that are considered are those that result in fund solvency under each scenario. Prepayment of assets and investment antiselection by the contractholder are treated explicitly in the model.

The technical details of my papers are concerned with how to find the region of all investment strategies that meet the surplus constraints. I have reduced this to a linear programming problem to determine the largest possible sphere of investment strategies. Roughly speaking, the sphere represents the resolution of the struggle between rising interest rate scenarios that force us to invest short and falling interest rate scenarios that force us to invest long. The radius of the sphere measures the degree of flexibility in the allocation of investable funds among the representative instruments.

In practical applications of the model, one finds that raising the interest guarantee causes the sphere of investment strategies to shrink, until, for some critical guarantee, the sphere becomes a single point. Above this critical guarantee there are no investment strategies that permit the product to be immunized against the defined risks. If competitive considerations dictate that the guarantee be higher than the critical guarantee, it is important to determine what scenarios the product is protected against, and the corresponding allocation of investable funds that immunizes against those scenarios.

MR. GARY U. ROLLE: As an investment man, I find myself at a slight disadvantage since my knowledge of product design is very limited. We are mainly investing in the trenches with the markets which we have available to us.

We have looked at successful investment operations of life insurance companies and have found that while their published rates were very competitive with the industry average, the rates of the eight companies* (Table 1) that we studied were greater than average. The predominant reason for the better than average yields that they attained on their portfolio was the ability to sell a pension product in an interest rate environment which was very high. Very little investment selection or shift in asset mix has had an effect on their investment return. Because the investments supporting this pension product had a longer horizon, they were in fact taking a futures risk in the interest rate market.

One other successful strategy we found was rapid investment turnover. This strategy involved the selling of low coupon issues and taking your losses or offsetting those with gains in other areas. The proceeds were reinvested in high yielding coupons thereby picking up the differential between discount bonds and current coupon bonds. This is a strategy we have advocated and can only be accomplished if profits are located in other areas or you must be able to realize the book loss. For a stock company, that is a difficult situation to justify to management. We have found that, particularly in the last ten years, common stocks and liquid portfolio real estate have enabled us to raise our investment rate to a level where we remain competitive without playing the futures market in the commitment game. Again, the commitment game that was going on in 1979 got several insurance companies in trouble because borrowing at banks was at very high rates.

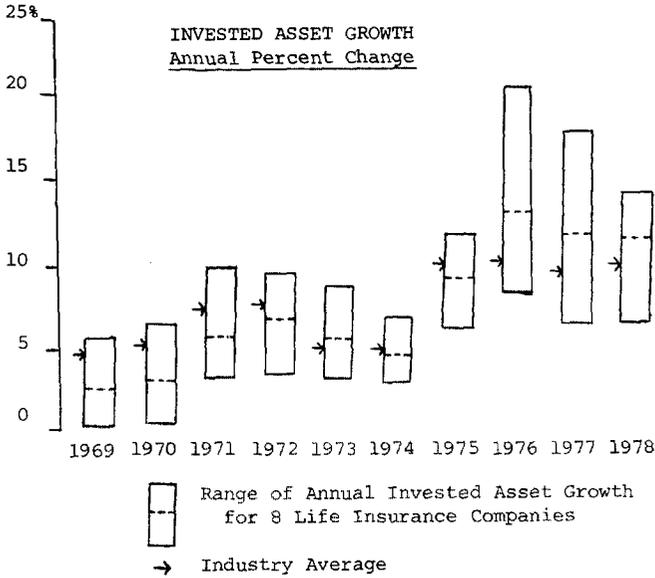
Table 2 illustrates four periods of interest rate changes. The darkest line ending with the dot in the middle represents the most current period, 1977 to the present. The movement in rates during this cycle shows a dramatic percentage change from the beginning of the cycle to the present time.

In addition to the noted changes in interest rates are changes to the yield curve. At the bottom of the cycle when a normal yield curve is in effect, short rates are in the 4 - 5% range and long rates are around 8%. In the most recent period, short rates were 18 - 20% whereas long rates were 14 - 16%. We had an inverted yield curve. Usually, the simplistic immunization concepts assume a flat yield curve where, as you approach maturity, reinvestment rates do not change.

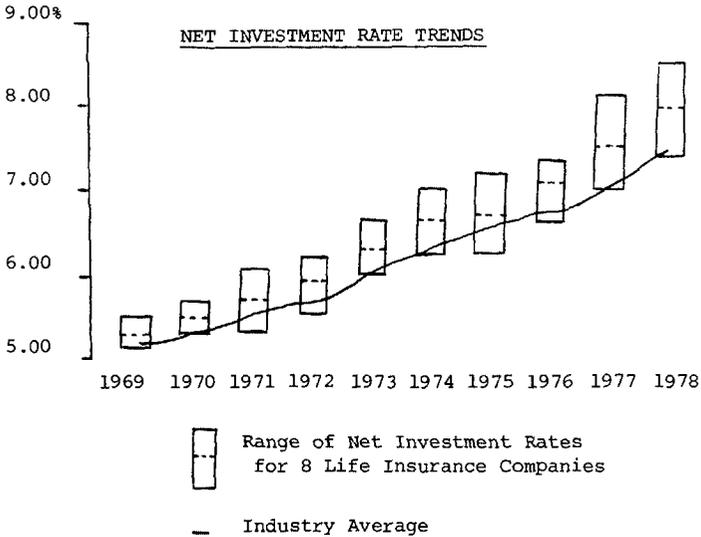
*Eight Life Insurance Companies: Aetna L&C, Conn. General, Equitable, Lincoln National, Occidental & TALLAC, Pacific Mutual, Prudential and Travelers.

DISCUSSION—CONCURRENT SESSIONS

Table 1



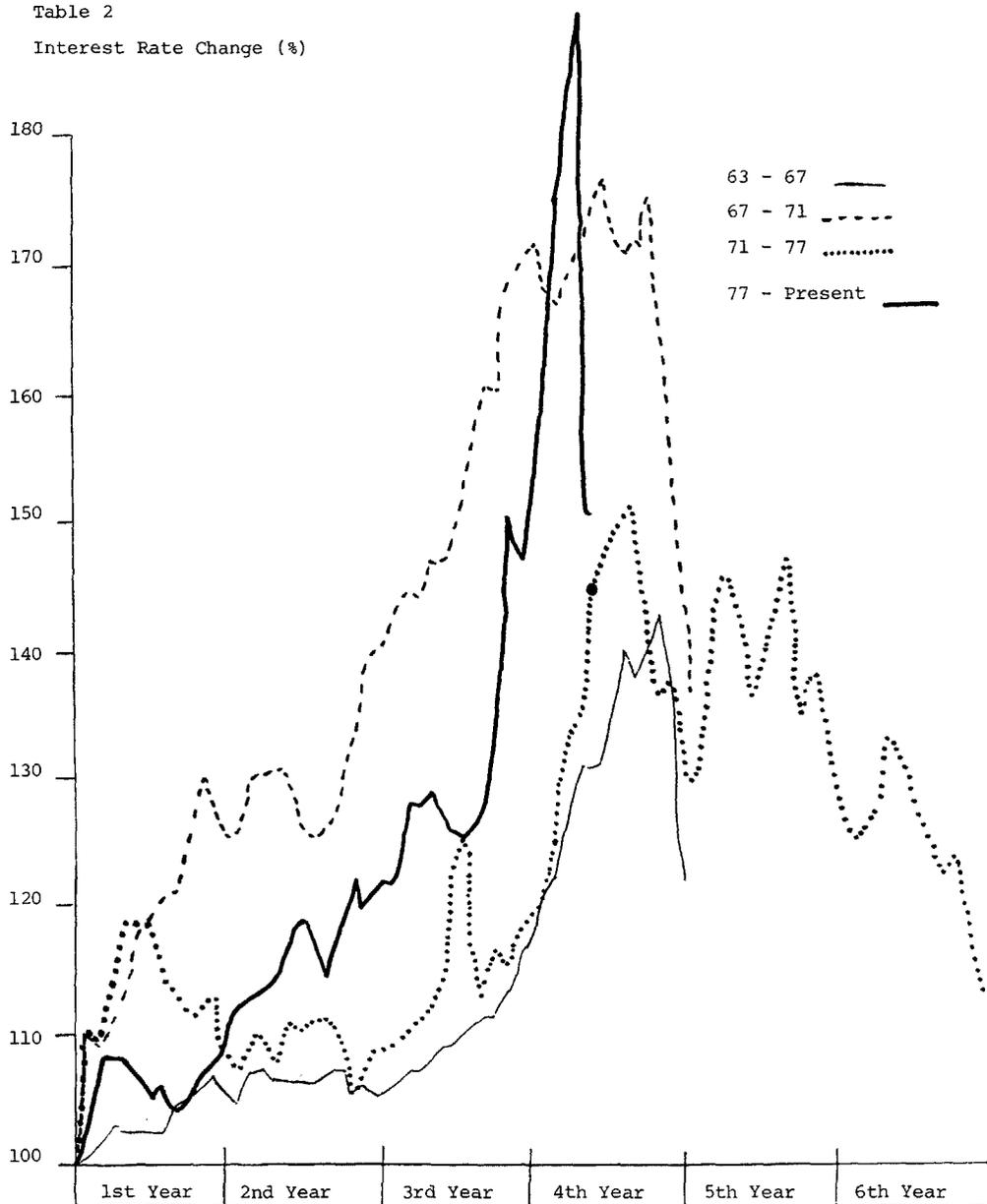
	1969	1970	1971	1972	1973	1974	1975	1976	1977	1978	Cumulative % Change
INDUSTRY AVERAGE	4.5	5.1	7.2	7.9	5.3	4.3	9.8	11.1	9.4	10.8	106.7



	1969	1970	1971	1972	1973	1974	1975	1976	1977	1978	Cumulative % Change
INDUSTRY AVERAGE	5.15	5.34	5.52	5.69	6.00	6.31	6.44	6.68	7.00	7.39	43.50

Table 2

Interest Rate Change (%)



Time Period from Beginning of Cycle
Yields

Trough to Peak	From		Months	Basis Points	
	To	To		BP	% Change
Feb. 1963 to Dec. 1966	4.18	5.96	46	178	143
Feb. 1967 to Jun. 1970	5.05	9.05	40	400	179
Feb. 1971 to Oct. 1974	6.83	10.40	44	357	152
Jan. 1977 to Apr. 1980	7.80	14.75	39	695	189

Table 3

BONDS ONLY
OR A
STOCK/BOND SWITCH

What is the value of buying and holding a long-term bond to maturity versus using common stocks to increase the principal value -- then converting the principal to an income stream by purchasing a long-term bond?

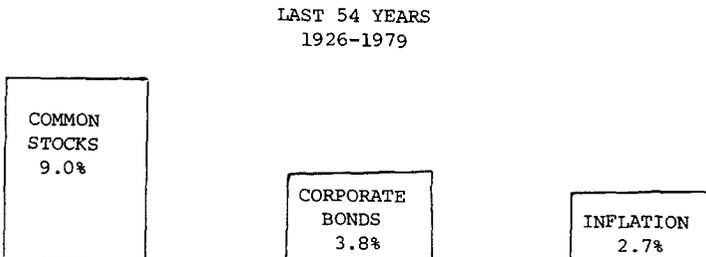
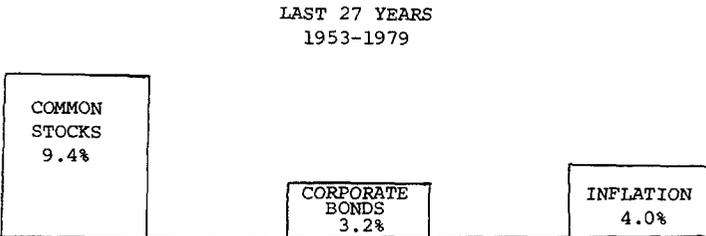
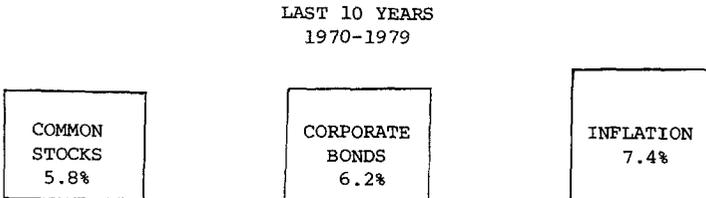
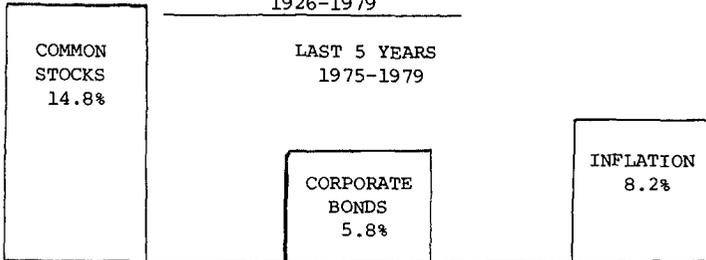
BOND INVESTMENT

BOND INVESTMENT 12/31/1970:	
8% Aa Corporate Bond Due 12/31/2000	\$1,000,000
TOTAL VALUE ON 12/31/2000:	
Maturity Value	\$1,000,000
Reinvested Coupon Income After-Tax:	
9 Years at 5.4%	
21 Years at 6.4%	<u>+2,526,000</u>
<u>BOND ONLY RESULTS</u>	<u>\$3,526,000</u>

STOCK INVESTMENT SWITCHED TO BOND INVESTMENT

COMMON STOCK INVESTMENT 12/31/1970:	
Standard & Poor's 500 Index	<u>\$1,000,000</u>
Proceeds 12/31/79, Including Dividends Net of Tax, of \$1,638,000 Switched to the 8% Bond due 12/31/2000 @ 73.08	
TOTAL VALUE ON 12/31/2000:	
Maturity Value	\$2,241,000
Reinvested Coupon Income at 6.4% After-Tax	+4,476,000
Tax on Gain of Discount Bond	- 169,000
<u>STOCK/BOND RESULTS</u>	<u>\$6,548,000</u>

Table 4
 IBBOTSON AND SINQUEFIELD STUDY
 UPDATED BY A.G. BECKER
 ANNUALIZED RATES OF RETURN
 1926-1979



We have found that the time period for investing at high yields is usually very short, or it is variable. It can last anywhere from two to sixteen months, but usually has occurred towards the shorter end. An aggressive investment policy when policy loans and low yielding commitments are already on the books is very hard to accomplish unless you have the flexibility in your portfolio to take down your commitments with your stock holdings or your real estate holdings and start a new investment cycle with new money.

Table 3 is a simplistic mathematical example showing what we have done several times. We would propose a position in real estate and equities in lieu of a position in long bonds. This equity position could be as high as the total surplus of a stock company. If the equity position performed as well as the S & P performed during the 1970s, a substantial capital gain after tax would result if the position was liquidated after ten years. The proceeds could be rolled into a bond at a discount for the remaining twenty years. The return of this strategy would be approximately twice the return received on a thirty year bond held to maturity that yielded 9% for the first ten years and 11% during the last twenty years.

Given the ability to select sound common stock and real estate investments, results as described earlier are achievable.

We have found again in periods of high inflation, equities do outperform fixed income securities (Table 4). Despite the volatility of common stocks and the lack of liquidity of real estate and despite the accounting and taxation implications, we have found several advantages exist. Capital gains are available to offset bond losses and to build surplus. High after tax dividend income may be earned. Equities provide insurers with the ability to ensure a rebalanced portfolio to take advantage of high rates when such rates are available.

MR. RONALD A. KARP: As you can see from the program listing, the caption for my segment of this panel is "Analysis of Investment Results".

I would like to begin by setting the scene with some introductory material on analyzing performance, in general, and then analyzing investment performance in particular. Then I will go on to some historical and background information on the subject which will include a discussion of the techniques in use - old ones as well as some of the new developments. Following that, I will then emphasize two critical aspects of investment performance measurement that will fall out of that discussion of techniques. The first of these critical aspects is the inseparability of risk considerations from return measures in the analysis of investment performance. The second is the fact that objective-setting and goal-setting are essential as part of the measurement process.

Finally, I will sum up by developing some thoughts as to the actuarial insights that play a major role in the investment and investment measurement process for assets which support a pension or insurance fund.

What is Performance Measurement?

In general, we are all aware of the many ways that we measure results. Measurement is pervasive in all aspects of business. I would venture to say that we have all been measured and evaluated and compared almost continuously from the day we drew our first breath right up to today. The measurements and comparisons take many forms. Some are statistical and precise, and are very objective, e.g., height and weight. Other measurements and comparisons are very qualitative and imprecise, i.e., subjective. An example of this might be some aspects of performance appraisals on the job. Still others are statistical comparisons that appear to be objective and precise, but which are really subjective and imprecise. It is these comparisons which are the most odious.

Many measurements in the investment field are of this type; they appear to be statistical only, but require much qualitative interpretation. It is my view that the difficulties surrounding the interpretation of results has discouraged much analysis in the investment field. I wrote a small piece on this topic some years ago entitled "Evaluating Investment Performance -- Science or Art?" The clear conclusion was that it was largely an art, but with beneficial outcomes nonetheless.

Performance Measurement -- Past and Current Practice

It is necessary to establish some framework for classifying the types of asset pools that we are considering. I will put forth a basic outline, although others could be used. The first division is by type of investor - I will be using pension funds and insurance companies. A second division relates to intensity of management which I will call active and passive management.

I shall begin with the pension field where there has been much more measurement activity. One of the reasons for that is that pension funds, particularly in the past decade or so, have tended to be actively managed and competitively sought, and that activity and competition has induced much of its own measurement.

We have always had some simple forms of measurement. The formula for yield or return: $\frac{2I}{A+B-I}$, is well know to us all. Among the earliest efforts to measure results in more depth were the studies at the Wharton School in the early 1960s. These were long-term studies of mutual fund results. Shortly thereafter the brokerage firm of A.G. Becker began to market performance measurement services to pension funds and really pioneered in this area. Subsequently, they and others contributed much refinement and elaboration.

The landmark study in this field was undertaken by the Bank Administration Institute. It was called "Measuring the Investment Performance of Pension Funds" and was published in 1968. In very general terms the BAI identified and clarified that the two relevant variables we deal with in performance measurement were return and risk. It surveyed the approaches for measuring return and developed some methodology for that. It argued that risk considerations were essential in evaluating investment performance, and it began to develop a body of knowledge about what might be appropriate measures of risk. This is an area where there is still not total agreement.

If we remain in the pension field where most performance measurement work has been done, the period after the BAI study was characterized by a growth of consulting activity in this area. It included manager selection and objective-setting work, as well as performance measurement. This was done mainly by brokerage firms and independent consultants, and more recently by actuarial firms. A still more recent development is the entry of banks into this consulting arena. They have the transaction data on their machines and can very efficiently compute returns and do other portfolio diagnostics. They are doing so as an adjunct to their master trust services. Moreover, some of the major banks are offering the full range of consulting services.

Necessary Elements in Performance Measurement

With that as background I'd like to highlight what I feel are the key elements of an approach to measuring investment performance. Remember we're still talking about an actively managed pension fund.

First, it must be based on market values. This is not to say that cost, or some other actuarial asset valuation approach is not appropriate for other purposes, such as funding, but for appraising results we must use market value.

Second, the measurement must utilize a total return measure -- including both income and capital gains, so that the result is not based on the discretion of the investment manager.

Third, the size and timing of capital flows into and out of the account must be considered. This has led to the two main types of rates of return utilized -- time-weighted and dollar-weighted. Time-weighted rates of return remove the effect of the size and timing of cash flow amounts, since these presumably are beyond the province of the investment manager. Dollar-weighted rates of return, which place greater weight on the sub-periods with greater dollar volume, are used for judging the fund's ability to meet its obligations, as opposed to evaluating the manager's performance.

Fourth, although it is probably not necessary to say, we must look at each asset category separately, e.g., stocks, bonds, mortgages, cash equivalents, etc.

Fifth, the return achieved must be evaluated in the context of the risks taken. There is no totally satisfactory measure of risk, no universally accepted one. However, one approach which was suggested back in that original BAI study was to look at the variability, or volatility of a fund. There are many measures of volatility, but one which has received the most attention to date is the beta factor. Beta is a variable which gives the relative volatility of a fund or a security compared to the market (e.g., the S & P 500 for stocks). There are many problems with the use of beta, such as its instability over time, the differences in its calculated value depending on the length and frequency of measurement periods, and also the lack of clarity that volatility is really a relevant measure of risk for pension plans. Nonetheless, it has received considerable usage.

Sixth, the results must be compared with some objective or goal to allow an appraisal of results. For pension equity investments, the S & P 500 has often been used as a standard, but there is no reason why it has to be. The comparison could well be with another index.

Insurance Company Portfolios

Many of these approaches or key elements of approaches that I have just mentioned for actively managed pension funds are clearly not relevant for an insurance portfolio. For example, the use of total return is not relevant in a buy and hold portfolio.

But I will make the point that I believe insurance company portfolios warrant as much analysis as pension funds, though they probably don't receive half the scrutiny. I think this comes from three main reasons.

First, with pension funds the manager is generally an outside vendor and the performance measurers are therefore willing to make a more critical analysis than they are with a co-member of their management team.

Second, the investment function receives inadequate scrutiny in an insurance company because the other members of management know less about it than they do about insurance activities, so they focus on the latter. How many times have you heard a reference in a property-casualty company to the fact that, "we get 80% or 100% of our earnings from investments, yet all of our attention is devoted to underwriting."?

A third difficulty is that the more passively managed, often non-marketable, insurance portfolios do not lend themselves to the same types of analyses used in the pension area.

There are several reasons why I feel insurance portfolios should receive more analytical work and measurement and evaluation. One is that it is simply a principle of good management and control to continuously monitor and evaluate any area of importance to the company. It might even be more critical for a discipline or a function which is not well understood by others in management.

Another reason is that, of the insurance companies which have gotten into trouble over the years, as many or more have done so because of their assets than because of their liabilities and underwriting. Probably the biggest current potential problem relates to the investment of assets supporting SPDA's, Single Premium Deferred Annuities. We've done some modeling which suggests that a typical life insurance company investment approach, i.e., put it all out at the longest available maturity, leads to bankruptcy (at least, for that line of business) under some very plausible assumptions about lapse and the future course of interest rates.

Another reason is that Boards of Directors, or Trustees in mutual companies, are increasingly being subject to critique by outsiders and some review seems essential for that reason.

If, as I mentioned earlier, the pension approach of viewing time-weighted, total, beta-risk-adjusted return is not appropriate for insurance portfolios, then what is? I think the answer is, it depends, but I would like to use that as a lead in to what I think are the two critical aspects or issues in any analysis of investment results.

Critical Aspects of Performance Measurement

One of those points, if you will recall, is that objective-setting and goal-setting are an essential part of the measurement process. Their connection with the rhetorical question I just asked about how to approach the review of an insurance portfolio is that such a review depends heavily on what are the goals or the objectives for the portfolio. You cannot just say, "Seek maximum return with a minimum acceptable level of risk," although many do so.

You almost can not begin to answer the question of whether results are good, bad or indifferent -- satisfactory or unsatisfactory -- until you have established some goals for the portfolio. To be sure, there are things you can measure and statistics you can compare, but the most meaningful appraisal of results, as with any kind of performance review, has to be in the context of the goals and objectives which have been set.

Once the goals and the investment policies which flow from them have been set, then the appropriate standards of performance can be established, and the approaches to measuring and evaluating that performance put in place. In this connection, I will point out that the last few years have seen much progress in making objective-setting a much more topical activity. On the pension side, the monitoring process has begun to place more emphasis on analysis of the current portfolio's characteristics to see if it is likely to meet future objectives -- than it does on simply computing past returns.

On the insurance company side there are some very clear and startling signs of the recognition of reality. Market values are getting much more attention. Some companies are beginning to utilize total return standards, at least for the marketable portion of their portfolios. Similarly, there is attention being paid to real return. These have led to a host of trends in investing insurance company assets, most markedly to a shortening of bond maturities (that may be fighting the last war), and more use of real estate and equities as inflation hedges. My point is that approaches to evaluating investment results must be tailored to the goals and objectives of the portfolio.

Besides the need for relating performance measurement to objectives, the other critical point I wanted to leave with you is that we are dealing with a question with two variables -- return and risk. Return is relatively easy to measure. Risk is much harder -- even to define, let alone measure. But notwithstanding this difficulty, you can not ignore risk in a portfolio, or you will encourage (or at least permit) behavior on the part of the portfolio manager that will benefit the variable you are measuring -- namely, return, at the expense of that you are not measuring -- risk. Incidentally, some of the myriad of techniques found under the heading of "Modern Portfolio Theory" are leading to a better understanding about risk.

So, whether you assess risk in terms of measure of volatility of the portfolio, or the quality ratings of the securities, or the financial ratio strength of the underlying issuers, you can not ignore risk.

Summary

To sum up, I have tried to add a little perspective to the subject of investment performance measurement. I view it this way. The investment function is one function in the operation of an enterprise -- here we have considered pension funds and insurance companies as the enterprises. While the details and nuances and substantive topics are different from other functions, the role of performance measurement in investments is no different from other functions.

For any function, one should set goals and objectives which are consistent with the goals and objectives of the whole enterprise, as well as compatible with those set for other functions. Then comes implementation. Then comes monitoring and review and performance measurement.

The performance measurement process serves three purposes. One is to test the effectiveness of the implementation. Another is to provide information to continuously re-evaluate goals and objectives. Still another is to enable better decisions for the future.

It is my contention that in these processes of establishing goals and objectives and setting risk levels and measuring and evaluating results, for enterprises such as pension funds and insurance companies, that actuaries are as well equipped as anyone to evaluate the issues and the inter-relationships between assets and liabilities. I think this area is a legitimate one for greater actuarial participation.

MR. MALCOLM R. REYNOLDS: You will have the chance to participate in some performance measurement when you complete the evaluation survey for this concurrent session. I hope that you will take advantage of this opportunity. I know that the results of these surveys will be of considerable help to the program committee in setting topics and recruiting panelists for future meetings.

I think there is an important connection to be noted between Jim's paper on the matching of assets and liabilities and Ron's comments on performance measurement. Ron did emphasize the point that as a starting point for evaluating performance, one has to have a clear view of what the goals and objectives are of the portfolios.

I think that considerable progress has been made in setting goals for pension fund management and this has enabled the development of performance measurement techniques. I think that in the case of the management of life insurance general accounts rather little progress has been made until relatively recently in setting quantitative goals. We have always had the motherhood goals of maximizing returns, minimizing risk and so on. However, in terms of setting reference points against which to measure the performance of investment managers, I think that life insurance companies have been very laggard. That is another explanation in addition to the several that Ron cited as to why we have probably seen very little analysis of the investment performance results of life insurance company investment operations. I think that Jim Tilley's paper together with a few others that we have seen over the last few years discussing immunization and asset and liability matching make an important contribution to that goal of managing investments effectively.

I think there is also a relationship between Jim's comments on managing assets and liabilities and some of the discussion of surplus needs that has arisen in some of the other concurrent sessions that some of you might have attended yesterday. Jim's technique can be effectively utilized to determine what surplus needs you have. In the event of certain scenarios and without that type of analysis I think that we are rather in the dark as to what the impact of sharply rising or sharply falling interest rates will be on our companies. I guess my intuitive feeling is that if the very high interest rates that we saw earlier this year had been substained for just a few more months, the results could have been devastating for our industry. I was becoming very concerned that a few companies experiencing tremendous policy loan demands might get into trouble to the point where they would have to take advantage of their right to defer advances under policy loan requests. This action could result in a run on the bank, so to speak, on both themselves and the industry generally and bring the whole industry's credibility into question. Hence, I think that in terms of management of the companies' surplus and resources, that it is well for us to pay heed to the asset liability matching issues that Jim is raising in his paper.

MR. STEVEN A. SMITH: Since First Colony Life Insurance Company is a relatively small company, we have found that many of the theoretical approaches similar to those presented today require more time and effort than we have to give. As a first step in analyzing investment results, we are developing an approach which is both simplistic and fast. Our method involves restating GAAP earnings in a format where, among other things, investment income is split into three distinct portions: (a) investment income on capital and surplus, (b) interest required on GAAP reserves and liabilities, and (c) excess investment income from operations.

Since we are still in the process of developing our thoughts on this matter, we have not firmed up our allocation rules. We have reached some conclusions on the matter. Certain of our assets, and hence the investment income thereon, are appropriately allocated to surplus. In allocating operational investment income by line of business, it seems clear that it would be inappropriate to allocate in proportion to GAAP reserves. For example, if you had two \$20 million liabilities, say one for ordinary life insurance and one for single premium deferred annuities, the life insurance GAAP reserve might require 6% interest while the single premium annuity GAAP reserve requires 9% interest. It would therefore clearly be inappropriate to allocate one half the investment income to each line.

A better approach would be to allocate investment income in proportion to GAAP interest required. Even this method would produce the same percentage gain or loss from operational investment income for each line of business. It would not take into account, for example, capital loss problems caused by ordinary life policy loans where cash flow from the single premium deferred annuity premiums are used to finance the policy loans. In such a situation, an investment loss of some kind should be recognized in one line or the other. Probably, the capital losses that would have been incurred had it not been for the cash flow of the annuity line of business should be recognized in the ordinary line and normal investment income would be allocated to the annuity line. We have not as yet decided on an easy method to accomplish this objective.

While the approach described above is very simplistic, it is also fast and is clearly better than no analysis at all. Furthermore, the process of going through the restructuring of GAAP earnings is likely to lead to appropriate analysis and questions such as in the case of the policy loan/single premium annuity example above.

MR. KARP: I think that you can get some interesting information from such an analysis. However, you must be careful in considering the purpose for which you are going to use that information. When you compute an interest gain based on your actual interest earnings compared to what was expected in your GAAP assumption, I think the answer you get is really an amalgom of two things. The first is the difference in what the capital markets have produced in the way of available interest rates and yields and that which you assumed at the time you did your assumptions. The second is how effective your investment officer has been in implementing the investment policy given those markets.

I would contend that in most time periods the effectiveness of the manager would be dwarfed by the difference between what the capital markets had produced and what you assumed they would be. So, I think that this type of analysis can be a valuable contributor as to how you look at your overall results but I think that it really does not give you much help in evaluating your investment performance when compared to the types of information you have used in evaluating other departments in the company such as sales or underwriting.

MR. REYNOLDS: I agree with Ron that there is probably a good deal of useful information in the kind of analysis you speak of. The shortcoming that I would be concerned about is that what you are outlining is entirely a retrospective type of analysis. The attraction I find in the kind of work that Jim is doing is that it is prospective. It projects what might happen in the future under certain scenarios. I think that it is important that we be cognizant of what can happen under various combinations of circumstances in the future and not get caught by surprise only after the fact.

MR. DONALD D. CODY: I would like to ask Mr. Tilley a question, but before I get to the question, I do want to congratulate him on a very fine paper and recommend his paper for general readership. I believe it is the first coherent, clear, complete description in actuarial literature of the upside interest risk in a liability short contract. The mathematics possibly is beyond some of us, but I believe that the mathematics is not the most important part of the paper. In my opinion, the most important part is the description of the questions. I do urge everyone to read it.

You might think that any good group pension actuary that designed a guaranteed investment contract such as Mr. Tilley examined would be pretty crazy. Actually, as Mr. Karp suggested, we have billions of dollars in individual annuities which are exactly the design he described with much more extensive guarantees. I am not surprised at Mr. Karp saying that under plausible scenarios that such a line could easily get into bankruptcy. This now leads to my question.

I ask it as a member of two committees. One is the Society's Committee on Valuation and Related Problems and the other is the NAIC Technical Advisory Committee on Dynamic Interest Rates. Both of these committees are involved in the question of the extent to which an existing portfolio of contracts utilize the existing capacity of a company. In other words, how much free surplus do you really have for additional such contracts? With these investment contracts, the risk is not the downside risk which we actuaries have been familiar with for decades, but a new upside risk which is created by the very existence of guarantees. In investment contracts, the liabilities can be called pretty fast and they are shorter than the assets you hold.

Although the line under some circumstances can get into bankruptcy, it does not necessarily put the company into bankruptcy, but it is necessary to raise ruin theory questions in this context. If you have a block of business and you are intent on issuing a contract which cannot be immunized for reasons described by Mr. Tilley because of its guarantees, how do you determine what surplus you should be holding against this speculation? This is an extremely important question. The valuation law is under scrutiny for being put into a dynamic mode. There is no structure in the law to allow for the upside risk, which does not even depend on a guaranteed interest rate. It depends on the very existence of the principal guarantee at the time that the scenario in fact occurs.

Mr. Tilley, have you give any thought to determining the quantification of capacity utilized for a given block of business of this type, so that you can advise your company as to extent of the surplus needed if they continue to do this kind of business?

MR. TILLEY: We have looked at these kinds of things. It is fair to say they are not in the form right now where they could be easily disseminated to people who have not given careful thought about the subject nor has it been written up in a way that would be appropriate for regulators or legislators.

Some of the studies that we have done have focused on accumulation new money products, including flexible annuities, single premium deferred annuities and group pension guaranteed interest contracts. We have actually subjected model offices of various blocks of this business to analysis under various interest rate scenarios and quantified the risk by looking at surplus levels at various points down the road. This work is similar to a collective risk and ruin theory problem. If you consider single premium products or guaranteed investment contracts where you get a lump sum up front, the potential losses per dollar of deposit are staggering. One of the scenarios studies was the J-shape scenario. In this scenario, interest rates start from a current level, then fall and hang low during the period of time when you are reinvesting funds and have little compounding of interest and rise fairly dramatically during the time you are liquidating the funds to pay benefits. Under those scenarios, if you just take a typical slice of investments from the general account, you find you can lose as much as 50 - 70¢ on every dollar of business you write. However, if you took the very same investments that are available and just took a different slice to back these contracts, you can reduce those losses to zero.

In order to quantify the probabilities of ruin or insolvency for lines of business, we use the model as it stands in a deterministic form. It determines an appropriate investment strategy that will cover you under ten or fifteen scenarios of particular types, shapes and magnitudes of drops and rises. Once this investment strategy has been determined, we subject that single investment strategy which is now assumed to stochastic analysis of interest rates and determine the probability of ruin. The results are often surprising.

To answer your question, I have looked at many of these things but they are hardly in a form that would be easily discussed, easily understood or easily written into a law. They are not in a form that would be of immediate use for any of your committees.

MR. CODY: You touched on a point that is a very good one. If you can segregate certain assets by imputation as can be done in some states and is commonly done in Canada, or if you can write specially tailored separate accounts and watch them carefully, or if you have a specialized subsidiary with proper financing, you can have a very different result. However, if you are using your general portfolio and you are abiding by the New York Financial Plan, you could rapidly be in trouble. Even if you have segregated assets of some kind but you do not observe the kind of constraints that you point out in your paper or even if you do there can be scenarios that can create problems. You need some surplus.

The question is, what is the required surplus under a given asset-liability product design distribution. This is a very important question to actuaries today and we have not even begun to answer it.

MR. TILLEY: I would say that the work that I have done is just the beginning. Initially I was really looking at the question of how can we help to tailor investment strategy since it must be very different from traditional strategies to back some of these products. In so doing, we quantified the interest rate risk, determined what the adverse scenarios were and recognized that different adverse scenarios apply to different products. What you suggest must be done. I have only made a start at it.

I would like to add one small comment about the New York situation. Everywhere throughout the New York law there are the words equity between blocks of business. It is true that one would experience difficulty right now trying to set up notional funds, whether they are legal or not, for each line of business and to take an appropriate slice of the assets that are tied in some notional sense to those liabilities. The very spirit of such action is very much within what New York claims they are interested in. I discussed this over the phone with Erwin Vanderhoof and he feels that it is only a question of not being timid in approaching the New York Insurance Department. He has indicated to me that his company is willing to look at this and pursue this in a much more active way very soon. He does not expect a protracted fight on this. In fact, he mentioned one company that already had permission to essentially match assets and liabilities by line of business.

MR. KARP: I think that the approach that Jim was using is a very sensible one. We looked at the maximum disaster outcome. One problem is to determine what is the outside scenario that you are willing to consider. I think, for example, if we had been answering that question nine months ago, we would have come up with a very different answer from that if we had tackled the same question today. I think what happened within the last six months is probably outside the range of what we contemplated. I do not know what the answer is but it is a tough question.

MR. WARREN LEISINGER: Mr. Rolle mentioned after tax yields in his presentation. What techniques do you use to make after tax comparisons? When you report to management, do you express yield rates after taxes and expenses have been allocated?

MR. ROLLE: During the year we adjust our marginal tax rate as the tax people see it coming and we do all of our investment on an after tax basis. I do not know the method of it. We have broken up our company into an ordinary company and a pension company so we have distinctly different tax rates for the two lines.

MR. DONALD M. OVERHOLSER: As part of your investment strategy, do you actually allocate specific investments to your GICs or is this all on paper?

MR. TILLEY: At the time the paper was written, it was in fact all on paper. What was required was to go to the New York Department and get authorization for a separate account which in fact is part of the general account to house these particular assets. We, along with several other companies, have got such an authorization and are now doing so. Hence, it is no longer just on paper, although I must admit that the actual application of this model and these methods in our company is just getting under way in a practical sense now.

MR. DOUGLAS G. DRAESKE: I want to refer to two comments that Mr. Reynolds made. First of all, you are worried about the credibility of the industry if it had to envoke its six month deferral of cash values. I think that this is a very serious problem that we are going to have to face some day. You also mentioned that some companies drew down their lines of credit with banks. I think that an alternative to the deferral of the payment of your cash values is to make a short term loan at a bank. You are anticipating that these ever recurring and ever higher peaks of interest rates are fairly short duration.

I would just like to add a third possibility which I am not sure how many people know. I was rather surprised to find out recently that the Federal Reserve Bank is available to an insurance company. If it finds itself in a position of illiquidity and cannot get credit at a regular commercial bank, it can go directly to the Federal Reserve Bank and borrow money.