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**ACTUARIAL ROLE IN INSURANCE
COMPANY INVESTMENTS**

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A session aimed at discussing the actuary's role and responsibilities with respect to life insurance company invested assets. The development of investment policy and the implications for pricing, reserving, guaranteed cash values, and policyholder dividends will be considered.

MR. SAMUEL H. TURNER: Does, or should, the actuary have a role, as a professional, in the investment process?

Does, or should, the actuary have a responsibility, as a professional, relative to the investment of assets?

The Academy of Actuaries now seems to say "no", at least in Interpretation 7-B with regard to actuarial opinions on statutory reserves. Will others--regulators, courts, legislators, the public, also say "no"?

Is an actuary in the U.S., the largest life insurance market in the world, a unique, sheltered, professional who, unlike his counterpart in other developed life insurance world markets, can attest to

- the reasonableness and propriety of yield rate assumptions underlying actuarial liabilities,
- the reasonableness and sufficiency of actuarial liabilities, without due consideration as to related assets?

Before considering actuarial responsibilities relevant to, and implications of the investment process, let me attempt to set the stage.

What is investment policy?

Investment policy does:

direct the investment process by defining risk and return objectives related to both short-term and long-term investment considerations; and set forth limits within which assets may be managed particularly as it relates to assumption of investment risks.

Investment policy does not:

normally advocate specific security decisions; deal with the timing of specific security transactions; and seek to "manage" the day-to-day investment process.

Changing and even conflicting considerations make the investment process complex, thus requiring organization and co-ordination of objectives through a statement of policy, and flexibility within stated limits and guidelines set forth in a statement of policy.

Traditionally, life companies have been generally conscious of their role as fiduciaries for the assets which back policyholder liabilities. In addition to limitations on the investment of assets imposed by statute and regulation - many life companies have exercised the prudence of an ordinary man in the management of assets.

However, for U.S. life companies, a more demanding standard may be emerging. Even though life company general accounts are not subject to the provisions of ERISA, it is nevertheless worth noting the standard of performance required by a fiduciary with regard to investments. ERISA states that investment decisions should be based upon

"the interest of the participants and beneficiaries... and with the care, skill, prudence, and diligence under the circumstances then prevailing that a prudent man acting in a like capacity and familiar with such matters would use in the conduct of an enterprise of like character with like aims."

Who defines investment policy of a life company?

Generally, the directors are held, by law, to be directly responsible for the investment of life company assets. The law also provides for a committee to be formed to direct the investment process. Should the Actuary be a member of this committee? If not, should he (or does he) have a responsibility to unilaterally provide input to this committee? Can an actuary really render an opinion as to adequacy of reserves without considering the nature of assets backing those reserves?

MR. CHRISTOPHER D. CHAPMAN: I will be discussing the professional responsibilities of the actuary relating to investment of assets and to investment policy.

To put the Actuary's responsibility into perspective we should consider what we mean by investment policy. I would define investment policy as a set of guidelines for making investment decisions which are concerned with a wide array of considerations such as:

- Type of asset,
- Term of investment,
- Degree of risk (AAA, BAA, etc.),
- Industry, region, political jurisdiction and particular firm,
- Tax exempt status,
- Size of individual investment,
- Timing of commitment,
- Selection of investment dealer/broker.

How then does one formulate guidelines for investment decision-making against this kind of array of investment considerations? Typically, a life company's investment policy will take account of factors such as:

- The general economic outlook, including the impact of inflation, monetary and fiscal policy,
- Perceived trends in interest rates,
- Current availability of different types and quality of investments,
- Legal and regulatory constraints on life company investments,
- Short-term cash flow forecasts,
- The investment analyst's assessment of the financial outlook for the firm,
- The company's current surplus position and income tax situation,
- Some general sense that since we are dealing with a life company, a significant proportion of medium to long-term debt is probably more appropriate than penny mining stocks or tickets on the Irish sweepstakes.

Given all of these considerations is there any significant factor missing in the establishment of guidelines for investment decision making? Unfortunately, YES. Most often, the missing element is the "raison d'etre" of the investment function of an insurance company. That is, to earn a rate of return which will at least satisfy the investment requirements inherent in the company's liabilities. It is from this point that the actuary's responsibility to the investment function must be measured.

Every product offered with investment guarantees is priced and sold on the basis of certain investment margins - that is, the expectation that investment returns will equal or exceed product requirements. These margins will have a satisfactory assurance of realization over the life of the product only if two investment conditions are met. These conditions, which represent the minimum investment objectives are:

1. Investments acquired are of a quality such that there is a high probability of receiving the expected return (this is the traditional focal point of investment policy in North America) and,
2. The investment portfolio is selected and managed in harmony with the insurance portfolio such that investment margins are maintained unimpaired by any changes in the future level of interest rates or market value.

It is the latter objective that is most often overlooked - that of managing the assets in harmony with the investment requirements of the liabilities. Or to state it in a more sophisticated manner, directing the acquisition of business in such a way as to manipulate and offset the investment requirements of various products thereby facilitating the co-ordination of assets and liabilities.

Some actuaries, because of a particular aptitude for, or interest in investment matters, and because of their technical training, may make a contribution towards investment policy supporting the first investment objective - that of asset selection and management to achieve superior yield. However, it is in support of the second objective, that of co-ordinating asset management with liability requirements, that the actuary is uniquely qualified to contribute to investment policy.

What, in this context then, should be the actuary's responsibilities? I would like to offer several suggestions.

To begin with, consider the measurement of investment return. It is not news to anyone that current annual statement bases for measurement of investment return are not totally satisfying. In particular, they are deficient in two respects. The first is that the bases of reporting investment income are not consistent with the concept employed in product pricing and in reserves of a steady, compound rate of return. Contributing to this de-sultory measurement process are:-

- Accounting for dividends only as the return on common stocks.
- Charging depreciation against the income of appreciation property.
- Discontinuities in income from debt due to sale of discounted bonds prior to maturity and reinvestment at higher rates of interest.

The second deficiency is that reported investment income on debt is "promised" return, that is, it is the return which would be realized if all contractual payments of both interest and principal were received when due. It is "gross" before any provision for defaults. I submit that our total financial management process would be greatly improved if we changed our definition of investment income to some measure of expected yield on both debt and equity. This expected yield would represent our best assessment of the yield which would actually be realized on each investment. It would hopefully rectify the current misconception that recorded income is a good measure of ultimate, realized return.

A number of suggestions have been made in recent years to the end of improving the measurement of investment return. These include, for example, different formulas for bringing realized and unrealized capital gains into income, methods of spreading

gains and losses on bond sales prior to maturity over future income, and changes in the operation of the mandatory securities valuation reserve to accumulate, as a charge against income, a debt risk premium in respect of defaults only.

Over the last decade there has been much discussion on these problems and I do not sense that we are even close to a consensus. With investment management becoming an increasingly significant component of financial affairs, I would strongly advise any life company to develop its own realistic position on investment income measurement - and to use it in day-to-day management.

The next investment responsibility of the actuary is to develop techniques that will allow companies to produce an investment strategy co-ordinating the selection and management of assets with the emerging requirements of liabilities. This is obviously easier said than done. It requires both a fairly sophisticated cash flow forecasting capacity and an appreciation for, what our British friends have termed, an "immunized" position.

Immunization is a term coined by the British Actuary, F. M. Redington, to describe a situation where the assets, held in respect of a given block of business, are so invested that the expected receipts from the investments, both capital and interest, together with the premiums to be received, would exactly meet the claims and expenses from that business in each and every subsequent interval of time. Under these circumstances, there will be complete independence of future interest rates and market values because no investment or disinvestment of any monies relating to the business would be required at any subsequent date.

The concept of immunization was developed around 1952, at a time when it was felt that interest rates were once again approaching historical highs and that life companies might become vulnerable to a decline in long-term interest rates. Even at this time, it was not expected that the immunization theory would be slavishly followed but rather that the theory could provide a yardstick from which departure could be made in the exercise of normal investment judgement. Perhaps the most important factor in determining the profitability of a life company's investment operation, over and above its ability to select investments which achieve superior after tax performance, is its ability to depart from an immunized position - so as to widen its investment margins over what they would be on an immunized basis.

Despite the development of immunization theory in the early 1950's, immunization rules never became a powerful consideration in life insurance investment in Great Britain and they had even less impact in North America. The first is, as Redington observed, "immunization is a two-edged sword; it immunizes against gains as well as against losses due to interest rate changes". At about the time immunization theory was promulgated, interest rates began a long upward trend which was continued to date, and life companies ignored immunization in order to take advantage of the rise in interest rates by shortening portfolio term. The second factor working against immunization has been the technical problems associated with its adoption.

In spite of these problems, increasing attention has been paid to the principles of immunization in North America in the last decade. Some reasons for this are:

- Interest rates have reached historical highs and, given some control of inflation it is reasonable to expect that interest rates will eventually fall back to some lower level.
- Interest guarantees in products are gradually increasing, reflecting the current higher level of interest rates.
- New money type products with high interest rate guarantees are becoming an increasing proportion of life company business.
- General economic uncertainties have reinforced investment tendencies to shorten the term of assets thereby making them more vulnerable to a decline in interest rates.
- The steady rise in long-term interest rates over the last 20 years has had the effect of covering off increasing expenses and worsening persistency to the point where most companies' profit margins may consist entirely of interest margins. In fact, interest margins may be covering losses from other sources.

For those of us not old enough to remember the interest rate crunch of the late 1940's, when many insurance companies were scrambling to generate enough investment income to cover their $2\frac{1}{2}\%$ liabilities, the difficulties of many financial intermediaries in the early 1970's due to failure to match assets and liabilities has been a warning to life companies that they should reassess their current position on interest margins. The lesson to be learned is that awareness of a company's position vis-a-vis immunization is critical to understanding the implications of any investment strategy that may be adopted.

This brings me to what I consider to be one of the great unanswered challenges to the Actuary in his relationship to the investment function. The ability of a company to identify and to depart from an immunized position depends on a number of factors. Perhaps the most important of these is its capacity to forecast changes in assets and liabilities; that is, to produce long range cash flow forecasts. Every life company should be asking this question: "What investment policies should be followed to-day to achieve the optimum improvement in the after tax investment margin in the foreseeable future in relation to the current asset position, product investment requirements and our corporate assessment of future economic trends?"

To be able to answer this question, a company must have the ability to look ahead. In fact, a company's present position can only be assessed in relation to expected future results. As more and more new money products with relatively short-term investment guarantees are added to liabilities, proper control

over the relationship between assets and liabilities in order to assure investment margins becomes critical. The ability to assess the current position and to pursue investment policies within a framework of product requirements as well as a general economic outlook is one of the areas of greatest potential to optimize future investment performance. Failure to do so invites the real possibility of a steady erosion of investment margins. It is clearly the responsibility of the actuary to provide the cash flow forecasting tools to enable this management process to take place.

Consider a further area for actuarial contributions to investment. Even if we are successful in developing a sound basis for investment strategy, we are still lacking any basis for measuring the effectiveness of our asset selection process. In other words, we need standards of investment performance which must, necessarily, relate to the initial or revised expectations for assets actually acquired. By analogy, we establish underwriting standards in the form of expected mortality and morbidity and we monitor actual experience in relation to expected. No such standards are available for our investment operation. This is not clearly an actuarial responsibility but one which I feel actuaries should respond to in order to fill the existing need. There are several reasons why performance standards are a necessary element in the development of investment policy.

1. A performance standard is initially stated as a quantified performance objective and, as such, can form a basis of communication between the marketing, actuarial and investment operations and even within the investment operation as between different types of investment.
2. A meaningful performance standard combined with feedback and evaluation of actual results can be a powerful tool to reinforce the investment learning and decision making process.
3. The existence of quantified performance standards will provide an operating discipline which otherwise might be missing.
4. An objective performance standard can act as a basis for rewarding superior performance.

Another area of actuarial investment responsibility is that of quantifying the risk taking capacity of the investment operation as a guide to the distribution of assets as between debt and equity and as to the quality of debt. Every company must make decisions on such basic issues as its portfolio mix and the desirable amount of investment reserves. In many instances, these decisions are made on the basis of subjective evidence and would be greatly enhanced if there were a means of quantifying the level of risk in the general portfolio.

A company's portfolio choice is a matter of finding a suitable trade off between expected return and risk. The ability to tolerate risk differs from one company to another and depends on the characteristics of the liabilities, the level of investment reserves and other factors which can be summarized in a so-called management "utility function".

The actuary may be able to blend the portfolio risk and diversification concepts of capital market theory with his own understanding of the factors limiting the risk taking capacity of an insurance company. The result would be a more objective basis of measuring the risk of insolvency, a demonstration of the effects of changes in asset mix on the stability of interest margins and a demonstration of a trade off between higher expected returns and higher investment reserve requirements.

MR. JAMES C. H. ANDERSON: I want to say a few things about the role, not of the individual actuary, but the actuarial profession in the whole area of investment management.

My personal crystal ball has in it some visions of the future that bear a resemblance to the things that Jack Bragg was talking to us about this morning. I foresee the need, if we are to continue to be a viable and growing profession, to expand our areas of involvement from those that have been our traditional province. The actuarial discipline is very suitable for a variety of other types of involvements and notable among these additional areas is the whole field of investment management. In this context, I would note in passing that in the United Kingdom, among the tracks to achieving fellowship in the Institute of Actuaries is the investment track. If one looks down the road for the next ten years or so, it might well be that the Society of Actuaries will also have an investment track towards achieving fellowship.

Some people see the role of the Actuary in the investment activities of insurance companies or even in their financial reporting as nil, as it relates to the assets. Other people see a single kind of involvement. In other words, an involvement of the Actuary in the fiscal responsibilities of the insurance company, ensuring that the assets are suitably invested, but having no further responsibility beyond that.

I tend to look upon the Actuary's potential involvement in the investment aspects of the company as a dual kind of involvement. I agree that the fiscal responsibility is there and I personally believe that it is inescapable. In addition, actuaries can function effectively as investment managers of insurance companies and I would have that on my docket for the future of our profession.

What I would like to cover very briefly are the ways in which an actuary can contribute meaningfully to the investment management affairs of an insurance company. There are five sub-topics that I want to deal with briefly and, I would acknowledge, incompletely. One is the risk aspect of investment management; the second is the tax aspect; the third is how to apply investment expectations to pricing; the fourth is special considerations that break the rules in other respects; and finally, how an actuary might participate in the investment strategy of his company.

Looking first at the risk aspects: I am impressed, to use a positive word for a negative reaction, by the non-relationship

between the investment risks companies are prepared to assume and the mortality risks they are prepared to assume. It has always impressed me that companies were prepared to make sizeable commitments of assets to particular types of investments, perhaps to various securities of one obligor, or of securities in one industry, or in one geographic area, in volumes that far exceed the retention limits of those companies.

If a company has a retention limit of \$250,000, is it consistent that that company should be prepared to underwrite investment risks of five million dollars? Those numbers are not at all disproportionate in my experience. There are many qualifications which need consideration: there is no such thing as a partial loss on a mortality risk but of course there is such a thing as a partial loss on an investment risk; the probable loss on first class debt securities is obviously different from the probable loss on mortgages, particularly on special purpose properties; and so forth.

Another factor affecting relative risks is the issue of tax. For some companies a mortality loss will be tax deductible and might, at least in the U.S. tax environment, result in co-insurance by the government to the extent of perhaps 24%. In other circumstances, a capital loss on an asset that went bad might likewise be subject to co-insurance by the government, potentially at the rate of 30%. Individual companies should consider these two risks ought to bear some relationship to one another, including the assessment of relative tax impacts of loss under either circumstance.

There is also the issue of the mandatory security valuation reserve (for those companies that have any left). In effect, investment losses can be written off against that reserve and, hence, would not threaten the financial position of the company in quite the same fashion as mortality losses.

The most important qualification of all is that it is relatively infrequently that one has a massive coincidence of excess mortality. However, the realities of the market place mean that if one investment goes bad, the probability is significantly increased that several other investments are also going to go bad. Consequently, that would suggest, on ruin theory principles, that one should be more conservative in fixing the outside limits of investment risks because it is likely that circumstances will develop adversely all at once with respect to a wide sector of one's portfolio.

The third point about risk is a simple one and relates to pricing. In establishing investment expectations for pricing purposes, it is my strong view that they should be based on no-risk investments. Various writers in the investment field talk about a risk premium that is attached to certain kinds of investments. In other words, a Baa bond might yield two percent more than a Aaa bond. I have had clients talk to me about the feasibility of pricing their products on the assumption that they were going to invest in medium grade utility securities which were going to give them an 11% yield. It is important that one unscrambles the risk premium

associated with investments like that from the pricing assumptions that one makes. Otherwise, there is a significant danger of double counting.

Now it is a nice question as to what no-risk investment yields mean in this context. The classical answer to the question is that it means the yield on either treasury bills or government securities. In the life insurance context, that is not a suitable measure because the market in government securities is influenced by the activities of central banks, by bank reserve requirements and by various other things that frequently produce artificial conditions in the government security market. A better measure of no-risk investment yields is, perhaps, Aaa corporate bonds or if you want to be adventurous, Aa corporate bonds.

Moving to tax aspects of investment management, the actuary is well suited to advise management generally on the choice of investment alternatives. I have been surprised at how few companies, particularly among the medium and smaller size companies, are actually fully aware of the tax impact of various forms of investment. This is a large subject and for those of you who are interested in it, I would refer you to John Fraser's paper on the subject (TSA XIV).

Turning to pricing, I have been surprised that a number of companies are pricing on the basis of pre-tax interest rates, even though the industry as a whole in the United States is taxed in substantial part on its investment income only and not its profits. For pricing purposes, it is necessary that after-tax interest rates should be used. This is clear for companies that are taxed on a taxable investment income basis only, and is at least desirable for those companies that are taxed on the mean of taxable gain from operations and taxable investment income.

Let us now consider the application of investment expectations to pricing. Typically, in the United States environment, here is how the process goes: One starts out with the assumed new money rates. In general it is typical that a declining yield is assumed. It would be typical these days for companies to be assuming a pre-tax new money interest rate of about 8%, declining to about 6% over a period of 10 years. At that point, there are two ways to proceed.

The typical and traditional way works like this: One assumes that the new money is invested, say, in 15 year bonds, and determines a portfolio yield. On the assumptions I quoted, this might work out to a first year rate of 8%, a fifth year rate of 7.6%, a tenth year rate of 7.1%, and finally a rate in years 26 and subsequent of 6%.

The alternative approach, which I personally favor, gives us more understanding of what the investment process is all about. Assuming the same new money rates and assuming the same 15 year investments, one can then approach the question of how do you introduce this into pricing by making the following assumption:

Assume that each year you take your cash flow and you invest it at the available new money rate and at the end of the year, you sell your investment, realize whatever capital gain or loss ensues and then reinvest it at next year's new money rate. Now, for the same assumption of yield reducing from 8% to 6% over ten years, here is the pattern of returns:

<u>Year</u>	<u>New Money Yield</u>	<u>Gain on Sale</u>	<u>Aggregate Yield</u>
1	8.00%	1.69%	9.69%
2	7.80	1.71	9.51
3	7.60	1.73	9.33
4	7.40	1.75	9.15
5	7.20	1.77	8.97
6	7.00	1.79	8.79
7	6.80	1.81	8.61
8	6.60	1.83	8.43
9	6.40	1.85	8.25
10	6.20	1.88	8.08
11 &	6.00	-0-	6.00

Let us look next at some special considerations relating to liquidity problems. The following examples are categories of business in which liquidity problems are relevant: Flexible premium retirement annuities sold in the tax sheltered market are particularly vulnerable to rapid turnover; certain classes of group deposit administration funds that have limited penalties on withdrawal are also vulnerable; then there is the policy loan problem; finally, there are those contracts in which the company is intending to pay excess interest on funds held based more on new money rates than on portfolio rates. This would typically be of the flexible premium annuity type, where in order to retain the funds, the company simply pays up to what new money expectations are and underwrites the risk of gain or loss depending upon the market.

All of these types of situations have one thing in common--and that is they raise the issue of what is conservative. Declining interest rates are not the conservative assumptions when one is talking about these kinds of products. In pricing these types of products it is necessary to test the hypothesis of rising interest rates rather than declining interest rates. Those of you who are familiar with what has been going on in the United Kingdom in the last few years, may know that a number of companies have encountered serious financial difficulties. These related essentially to the problem of rising interest rates coupled with guaranteed surrender values.

Turning to the actuarial aspects of investment strategy, Chris Chapman has already touched on the importance of doing cash flow projections and I would only add one comment. Companies need to do more than one cash flow projection because the cash flow projection will look very different depending on what the environment is. I cannot believe that a given company would

have the same cash flow outlook if new money rates went to 12% as it would if new money rates went to 5%. It is important for companies to know just what the consequences are of these two hypotheses or whatever other hypotheses one wants to make.

An aspect of investment strategy that has some appeal to some people applies to classes of business where the liabilities are of a relatively short term nature--for example, immediate annuities. The strategy is to commit funds received in a deliberately over-long position, thus committing your future cash flow at current investment rates. If the current investment rates are comfortably and substantially higher than the interest assumptions included in either pricing or GAAP or statutory accounting, this may be an attractive alternative. This is an example of how the application of actuarial thinking to the investment problem can involve strategy.

There are some GAAP implications of investment strategy that have some important bearing on the affairs of insurance companies, as viewed from the shareholder perspective. One is that capital gains and losses are depreciated currency as far as reported earnings are concerned, even though they are included in the bottom line. The investment community has a way of depreciating the importance of capital gains and losses. This has considerable bearing on the issue of investment in equities such as real estate or common stocks because this type of investment generally involves a sacrifice of current yield in the expectation of ultimately higher returns.

There are a few areas where actuaries can make an important contribution to risk-limiting strategies of insurance companies and generally these risk-limiting strategies involve a trade of potential capital gains for current income. One is the options market that has become prominent in the U.S. in the last couple of years, and another is the convertible securities market that has been with us for some time.

In summary, the actuaries' role in investments is an important one. It is much wider than the traditional view of that role and lends itself to expansion, even into the direct investment management field. The actuary can make contributions to companies in assessing their risk taking ability. He has an important contribution to make in the tax area. We have discussed the application of investment philosophy to pricing. We have addressed the liquidity problem which I see as the greatest single investment risk that this industry is underwriting today. Finally, we have looked at the strategic aspects of investment policy and how the actuary might participate in that.

MR. RICHARD W. ZIOCK: Actuaries can contribute a great deal to the proper management of life insurance company assets. In addition they can perform a meaningful role in investment policy decisions, using their knowledge of the liabilities side to arrive at an integrated solution to investment policy problems.

One way in which this integrated solution can be arrived at is by computer simulation of the projected future return from various classes of investments. Such computer simulation inputted to the financial algorithms of the company (in the computer) can serve to project probabilities and ranges of results of various strategies. This is a very attractive approach and has found favor with many of us. But, at base such simulation are only as good as the underlying models of future returns. Of course I have in mind stochastic models which are also sometimes called random walks. Being very knowledgeable about our companies we can design the computer model of the company with skill and confidence; but when it comes to the random walk model, we essentially take something we didn't make. We are more uneasy. Many actuaries have expressed misgivings about these models. Dr. Henry C. Wallich, who addressed us at the recent Washington meeting once wrote (5):

Trying to explain the random walk hypothesis to a securities expert is like putting a person through psychoanalysis: the securities analyst, who in this case occupies the place on the couch resists what he is learning because, like the patient in real analysis, he does not like it. But as the facts begin to fall into place for him, he wonders how he could ever have overlooked them. He also finds that, in many respects, he is a great deal happier with his new understanding.

A lot of the actuaries' reaction to the random walks is due to misunderstanding. I want to spend most of the rest of this discussion correcting these misunderstandings. I hope at the end you will be happier with your new understanding.

The objections actuaries have mentioned are:

1. Stock prices and interest rates are not random, but they are determined by events, supply, demand, etc.
2. The government through the Federal Reserve essentially controls these, so they are controlled by human beings and therefore not random.
3. If they are random how do we know the parameters have not changed. Let us examine these in order.

People who say "I do not think stock prices or interest rates are random" are saying that price movements are caused by real events such as supply and demand, labor strikes, changes in corporate earnings and a host of other causes too numerous to mention, and that therefore they cannot be random. They would say that price changes are either deterministic (i.e., caused by events) or random; clearly they are deterministic, therefore they are not random. Let me state very clearly that I agree that stock prices are determined by external events. To hold otherwise would be ludicrous.

The randomness could be defended simply by stating that the random walk provides a very good mathematical model which fits the data. That would suffice for me. But there are deeper reasons why it is a correct model.

In fact, the deterministic model and the random walk model are not opposites, but, surprisingly are complements. In the theory of finance the efficient markets hypothesis provides the justification for the random walk. A corollary of it is that if prices were not a random walk, i.e., if there was some systematic exploitable trend or movement which occurred regularly, people would exploit it. That very exploitation would remove the systematic movement. Stated another way, if for example, every leap year on days with full moons, the market rises 10% were the case, some smart people would discover that fact and buy stocks before and cause the rise to take place before scheduled, eliminating the scheduled rise. Does this idea conflict with the deterministic model? Of course not. Even if some deterministic event occurred in such a manner as to be predictable, then the resulting price movements would be exploited earlier and the time of the effect of the event would be changed but not the effect of the event.

In summary the phenomenon seems similar to the "cone". Hold it one way and its projection appears like a triangle, hold it the other and it looks like a circle. Both are right. The same is true of price fluctuations; they are both determined and random.

The 2nd objection above is that the Federal Reserve dominates the market. The efficient markets hypothesis referred to earlier requires only that there be (1) absence of monopoly power by any participant and (2) information freely available to all. I have been informed that their influence is at most a minor oligopolistic one. If you believe that the stock market is efficient, which more people seem to believe, then the bond or interest rate market must be efficient also because these two markets compete and money flows between them without restriction.

Two more facts: (1) The Federal Reserve failed to successfully hold down interest rates just after World War II for more than a short period and (2) the Federal Reserve has been around since 1913, yet the data statistically seem to come from random walks. Finally bear in mind that we use a random walk model because it is justified by the efficient markets theory but also because the causes are too numerous and complex to catalog and use for prediction. When there are so many causes and the purpose of the model is to ignore individual causes but to consider their collective randomness, it seems anathema to select one, e.g. the Federal Reserve, and say that it now invalidates the model, unless it can be convincingly shown that its influence dominates all others.

Finally the 3rd objective questions the time constancy of the parameters of coefficients of the model. People usually have in mind that inflation has altered the game. Perhaps so, perhaps not. But we are using a statistical model which was originally

derived to predict the random motion of gas molecules. Hence when we use the model we do not know anymore about the prices than we do about gas molecules. Let us test for a different underlying model by the same statistical techniques which were used to derive the model. Human judgement in such has not proved reliable.

I now wish to switch to a discussion of some applications of these models, some of which have been done together with some of which may not have been done:

1. Calculate the cost of asset value guarantees when policy assets are invested stocks. Turner (4) and DiPaolo (2) have done this in our literature.
2. Determine the proper percentage of surplus which should be in equities. The ideas expressed by Donald D. Cody (1) at the recent Washington meeting or similar ideas can be quantified more accurately with stochastic models.
3. Determine the optimal distribution of bond duration.
4. Determine whether an investment year method of investment allocation or a portfolio rate is superior.
5. Determine the interest rate delta i.e. the margin which allows that with some high probability, say 80-85%, the final policy asset share will equal or exceed the reserve. This approach was followed in (10). The delta there came out to be about 1/2 of 1%. That is to say deducting 1/2% from the realistic ultimate rate results in an 85% chance that the asset accumulation exceeds the reserve.
6. Determine probabilities of being able to meet projected dividend schedules.
7. Determine losses incurred in troubled times if bonds have to be sold below cost to meet cash value demands.
8. Determine investment mix which minimizes future taxes or maximizes after tax net gains to shareholders.

Since all of the above interact with the investment mix they can be considered as questions of investment policy or the effects thereof.

REFERENCES

1. Cody, Donald D. "Discussion Note: Common Stock Policy Related to Company Statutory Surplus." The Record Vol. 2, No. 1 (April, 1976) Chicago, Illinois: Society of Actuaries.
2. DiPaolo, Frank P. "An Application of Simulated Stock Market Trends to Investigate A Ruin Problem." Transactions of Society of Actuaries, XXI (March, 1970), 549-62.
3. Lorie, James H. and Hamilton, Mary T. The Stock Market: Theories and Evidence. Homewood, Illinois. Richard D. Irwin, 1973.
4. Turner, Samuel H. "Asset Value Guarantees Under Equity-Based Products." Transactions of Society of Actuaries, XXI (March, 1970), 459-493.
5. Wallich, Henry C. "What Does the Random Walk Hypothesis Mean to Security Analysts?" Financial Analysts Journal. (March-April, 1968). 159-62.
6. Ziock, Richard W. "A Realistic Profit Model for Individual Non-Participating Life Insurance." The Journal of Risk and Insurance. (September, 1973), pp. 357-373. (Also see an "Addendum" in the March, 1974 issue, pp. 179-182).
7. Ziock, Richard W. "A stochastic Model of Bond Prices." Actuarial Research Clearing House. Issue 1973.2.
8. Ziock, Richard W. "A Time Series Analysis of Bond Prices." American Statistical Association: 1973 Proceedings of the Business and Economic Statistics Section. (American Statistical Association; 805 15th Street, N.W.; Washington, D.C. 20005) pp. 648-652.
9. Ziock, Richard W. "The Interest Rate Delta" Actuarial Research Clearing House. Issue 1975.1.
10. Ziock, Richard W. "The Probability of Realization of an Interest Rate Assumption." Actuarial Research Clearing House. Issue 1973.4.

MR. PAUL E. SARNOFF: I agree with the importance of investment policy in the professional work of the actuary. However, in most insurance companies in America, there are other officers besides the Actuary who are responsible for investment policy, there is the controller, the treasurer and the investment officers.

The NAIC has recently instituted a requirement in the annual statement that the actuary submit a statement of opinion as to the reserves. The Academy responded to this requirement by providing Recommendation 7 and some interpretations intended to guide the Actuary in the development of his statement of opinion as to reserves. It is not the function of the Academy to enlarge on a requirement of the regulatory body. I do not think you are really suggesting that and I was a little surprised to hear you imply that the Actuary's role is circumscribed by Interpretation 7-B.

MR. TURNER: My implication is based upon an apparent selection between two alternatives. On the one hand, the Academy could have said in response to the NAIC requirements--here is how you go about judging the adequacy of reserves, here are your responsibilities, here are the guidelines, without specifically stating that you do have nor do not have any responsibility for looking at the assets backing liabilities. This would correspond to the NAIC requirement.

Alternatively, the Academy could specifically say that there is no responsibility in this area. This seems to be the position taken by the Academy in Interpretation 7-B. The Academy says: you do not have to look at assets, and can take them at stated values; and you can accept the Investment Yield in Exhibit 2. We have discussed a lot of the problems in looking at the Exhibit 2 yield rate and judging whether or not it is relevant to assumptions appropriately underlying reserves.

Could any of the Fellows of the Institute in the U.K. offer us any insight as to why an actuary should look at assets backing liabilities?

MR. EDWARD A. JOHNSTON: The reason is really very simple, an actuarial valuation is a comparison of assets and liabilities and it just does not make sense to look at one without the other. If you just get a certificate as to the value of the liabilities, it does not mean anything because that certificate is only justified if the rate of interest is one that can be earned by the assets and if the assets will actually provide an incoming cash flow at the time needed to pay the liabilities. Just to carry out a little discounting exercise on the liabilities, does not give one the answer.

MR. TURNER: If the actuary does not have any direct responsibility, day-to-day, to manage assets, perhaps you have an investment officer who can certify as to the propriety and adequacy of assets, whether or not he is an actuary. Why must the actuary take on that responsibility? Why cannot the guy in charge of assets say the assets are okay and the guy in charge of liabilities say the liabilities are okay?

MR. JOHNSTON: It is the relation between the two that matters. One cannot look at either side of the balance sheet by itself. This certainly does not imply that the actuary should have any day-to-day responsibility for managing the investments. It implies that he should be aware of the investment strategy. He should be able to say to his directors, "if you follow the strategy which you are thinking of, I will not be able to sign the certificate". That is his responsibility in the investment area.

MR. BRUCE E. NICKERSON: Dick Ziock referred to the efficient market and the fact that from it flows the random walk hypothesis. Earlier, we had a discussion of immunization theory and what I interpreted as at least tacit approval, that companies, if they determine what their immunized position is, might still have good reasons for departing from that position for reasons of additional gain. Putting those two sets of discussions together, would not a departure from an immunized position be justified only if the investment people felt that somehow the market was inefficient and they had an edge on it?

MR. ZIOCK: Immunization is fine for Great Britain, but it is not for United States or Canada. We have a different type of product here, our product has guaranteed cash values, in Britain cash values generally float up and down with the asset value of the company. Another fault that I find with immunization is that in Britain they have perpetuities, and we have no such long term investment medium available here, except stocks. Stocks are in essence perpetuities, but their underlying values fluctuate. In addition, stocks are not available in sufficient quantity under our laws to meet the perpetuity requirements.

Under the efficient market hypothesis we agree that things are deterministic. There are real events determining the underlying price movements. At the same time the market is so efficient that in effect the price movements are random walks and it is impossible to exploit them systematically. That does not obviate the need for the investment man who has some idea about the underlying trends in various industries.

There are two different types of random walk hypothesis, the broad form and the narrow form. One of them implies that nobody can ever make any money. The other one, the narrow form, just implies that the stock market will be a random walk. I do not know if I am prepared to go all the way with the broad form which says we can fire all our investment people and let them go away. There is a need for them even though we use the random walk model which is based upon the efficient market hypothesis for testing various inter-relationships between our investments and our portfolio of policies.

MR. NICKERSON: I would like to clarify as a side point that even under the efficient market hypothesis, if one fires all of one's investment managers, the corollary is that one becomes one of the inefficiencies in the market that keeps the market from being totally efficient. That may not be a desirable thing to do.

Perfect immunization is an impossibility for a variety of reasons, but I was more interested in the question, assuming that a company can determine, and I think this is possible for a U.S. company, roughly how far it is from being immunized. Are there reasons, other than potential investment gain, in the sense of this market edge or whatever, why a company should go perhaps farther from an immunized position?

Jim Anderson referred to deliberately investing long, which is a departure from immunization. I understood his comment as saying that you would do this if you had reason to believe that you would get an edge this way. I interpreted this, as being a departure or a denial of the efficient market hypothesis.

MR. ANDERSON: On the whole, the facts bear out the conclusion that the risk premiums one collects for lower quality investments and the premiums one collects for illiquidity are more than necessary to pay the claims. So that if you think that it is tolerable to depart from a matched position either in liquidity terms or in risk terms, there is an authentic way of expecting that your overall yield might increase.

I am not a "random walker". The market is nearly a random walk, but I doubt that we will ever have the statistical evidence to support that one way or the other. I would estimate that it would take a couple of hundred years of data to distinguish between a real random walk and a nearly random walk.

One often hears evidence of this kind put forward to support the random walk hypothesis. "Who have you seen outperform the market?" The answer, usually, is nobody or nearly nobody.

Let me turn the question around, if the market is a random walk, it also should be impossible to underperform the market. Now the question bites in the other direction. Few of us in this room would be prepared to accept the hypothesis that there is no way to underperform the market and yet that is implied in the whole theory of random walks. So I am not 100% "random walker", but I may be 90% or 95%.

MR. ZIOCK: If you have a true random walk, there will be some people, just statistically, that will outperform the market by throwing their dice and investing their money. There will be a normal or some kind of distribution, and there will be tails.

I agree with you on the nearly random walk. There is much research on random walk reflecting barriers. All kinds of things that I would agree with. The market is random only to the extent that the imperfections are unexploitable.

MR. TURNER: Dick, as I remember, you do not assume everything is totally random do you? You have two or three components?

MR. ZIOCK: Yes, that is in my bond price algorithm. There is a central tendency component and there is another one, that I am less sure of, called a run component. The central tendency component just reflects that, if interest rates get real high or

real low, there are corrective forces in action. This is supported by economic theory. If interest rates are very low, investors will borrow money and eventually force rates up. On the other hand, if rates are high, capital investors will abstain from investing and thus, cause a downward tendency.

This central tendency is not great enough to exploit. Both the central tendency and the run tendency only explain about 13% of the variance in the bond market, which is not sufficient to trade on.

MR. CHAPMAN: It might help to explain your question regarding immunization to put yourself in the position of a new company which is going to sell only single premium annuities. Your tendency would be, given the competitiveness of the product, to think very carefully about matching assets and liabilities. I chose single premium annuities because they are the kind of liability where it is relatively easy to predict the cash flow if your mortality assumptions are going to be pretty accurate.

Given that your mortality assumptions are about right, most of your profit is going to come from the investment margin that you assume, consequently, if you want to sort of "assure yourself" of a profit on this block of business, you will match. On the other hand, if you want to take a position of one sort or another about where interest rates are going, then you might invest shorter or longer. There is nothing wrong with taking a position.

The problem with most companies under today's environment is that they do not know whether they are taking a position regarding interest rates. Furthermore they do not know what position they are taking.

I do not really agree with Richard regarding the existence of cash values. That just makes the problem a little tougher in North America than it is in the U.K. Secondly, you do not really have any assets that are long enough to match exactly with a traditional life insurance portfolio but you can mix and match your liabilities as well as your assets. So you could take my original portfolio of Single Premium Immediate Annuities and mix into that some other business with different liability cash flow characteristics. The effect of which would be to allow you to take a different posture on your assets than you might if you just had a liability portfolio of all single premium annuities.

The essence of the problem is trying to get a fix on what your liabilities are telling you and then to relate your assets to that and to see where you stand.

MR. PETER N. DOWNING: I am from the U.K. There has been a rather fascinating dialogue going on here on the difference in the product mix in the U.K. and the United States and whether immunization theory is appropriate or not. Let us postulate a situation where a company goes broke. I would suggest to you that this could happen from two reasons, either the assets are inconsistent with the product mix or the product mix is inconsistent with the assets.

Who is going to have the finger pointed at him, is it going to be the Accountant, or is it going to be the Actuary? Whichever way you answer that question, you want to be satisfied that if the finger is being pointed at you, the Actuary, you are on firm ground.

We come back to the question, which controls which? If you have only got a certain investment mix available, should that restrict your product design and product mix? Only the actuary can say that a certain product mix should have an impact on investment strategy. In both situations, it ought to be the actuary who is critically involved in the investment strategy.

MR. WILLIAM SHINKWIN: One of my continuing projects is to provide our investment officers with factors which relate the income from different forms of investments. We call them taxable yield equivalents. These factors depending on the investment, translate the income from that investment to income on fully taxable investment income. I am curious, do other people do this? Do they focus on, if there be any others, pre-tax income or do they focus on an after tax approach?

MR. CHAPMAN: Our company in comparing investment alternatives, certainly with respect to one or the other choices within the same category of assets, but often as between for example, real estate and mortgages or bonds and mortgages calculate after tax equivalent yields. So we convert all of our presumed interest rates on investment to a net after tax basis.

The one thing that bothers me about what we do or maybe about what we do not do is that we still deal on what I would call the promised yield, on all of these investments. We do not deduct some kind of a risk premium from the promised yield to give us an expected return which would equate between one asset and another.

