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ACTUARIAL PRICING ASSUMPTIONS IN A VOLATILE ENVIRONMENT

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Recorder:	STANDLEY HOCH

o Traditional approaches

o Modern approaches

- Mortality (smoker, guaranteed issue, unisex)
- Interest (C-3 risk, guarantees, matching, policy loans)
- Expenses (computer costs, inflation, guarantees)
- Persistency (distribution systems, markets, economy)
- Reinsurance
- Taxes
- Interrelationships
- Stochastic versus deterministic methods

MR. WILLIAM R. BRITTON: Our environment is changing with a degree of rapidity that none of us could have predicted. Rapid movements in interest rates and inversions in short-term and long-term rates are becoming more common. Newer risk classifications are requiring us to set mortality assumptions for classes where there is really no experience. Product designs are opening up more potential for mortality antiselection. Instead of worrying about what we used to consider normal inflation, we are now faced with expense spikes caused by system outlays and new servicing requirements on the policies that are now being issued. With regard to persistency, the past is no longer predictive of the future. We are also seeing the emergence of nontraditional distribution systems. Finally, we are dealing with the third federal income tax law in the last three years, and we are facing the prospect of an even more fundamental change in the federal income tax structure as a result of the recent Treasury proposal.

MR. LORNE CAMPBELL: From the perspective of my former job, I request that actuaries try to find some innovative sources of product improvement and not merely continue to chop at the sales agent's compensation. In my presentation, "my company" means my former company.

The intention of my presentation is to convince the audience that the pricing actuary is required to be significantly more diligent in a volatile environment. A volatile environment exists when change is accelerating.

My company has a ratebook based on a certain package of assumptions. When necessary, we retool a particular product or add a new product. When experience is starting to diverge from the assumption package too greatly we introduce a new ratebook rather than adjust it further. We introduced ratebooks in 1960, 1974, and 1980. The 1980 ratebook lasted until 1984, and I would predict a short life for this 1984 ratebook were it not fashioned from disposable modules. The insurance company has entered "the throwaway society."

When I started observing the pricing of single premium immediate life annuities in the late 70s, we changed the rate basis as often as three times per year. Now our rate changes are approximately monthly, although we have changed the rate basis twice in one week this year.

An American Council of Life Insurance (ACLI) study predicted that on average member companies would introduce four new products in 1984. I believe that this would amount to a new product introduction every twenty minutes of the typical working day. Actually I believe that the rate of change is so steep that every fifteen minutes might be more realistic.

The yields of U.S. Government securities over the last forty years are instructive. They prove that we are in a "volatile environment."

Toffler's book Future Shock, was aimed mostly at the individual, but early on he notes that "the roaring current of change is a current so powerful today that it overturns institutions." It was my intention as a pricing actuary not to be instrumental in overturning the institution which paid my bills. It is now my intention to suggest that inadequate actuarial diligence can threaten even the mightiest of insurance companies. But if I am incorrect in my gloomy portents, I would be more than delighted to be instructed by members of the audience on some of the modern pricing miracles which I can't yet manage.

Before reviewing some details of pricing, I would like to introduce two computer concepts. The first computer concept is BIG THINK. This machine is a weapon in the hands of the astute actuary or student, and senior management can sleep soundly with BIG THINK plugged in, analyzing the myriad of pricing pitfalls. Unfortunately, this same computer can turn into the second concept, BIG FINK, in the hands of an equally astute agent or consumerist. BIG FINK is the master of antiselection. If the pricing actuary errs, then senior management can be assured that BIG FINK will zero in on the area of deficiency.

Last month I was sent a chart showing the internal rates of return for a dozen products aimed at the nonqualified executive benefit market. The agency whose computer produced the chart also listed thirty-one other products whose returns were too unattractive to cut the mustard.

All products were offered by A+ carriers. Senior management of the carrier with the number-one product in this study was either ignoring the threat of BIG FINK, relying on their actuaries' skills, or at the minimum, assuming that numerical comparisons alone don't sell insurance products.

In my day to day work I do not have much leeway in the area of profit objectives. Therefore, my difficulties tend to be associated with the inability to justify pricing assumptions which provide a so-called highly competitive product. In 1984 the average new policy size at my company was $172,000 and we didn't sell much term. My discussion therefore has to be paired with a marketing strategy which requires a highly competitive product.

While I can't accept "match the competition" as a pricing methodology, commitment pricing is often inevitable and even a useful discipline. Marketing considerations may obligate a company to implement expense containment strategies and price in anticipation of the reduced unit costs. If the strategy is responsible and realistic then I have no problem.

At my company we price using assumptions based on recent company experience. If we have inadequate experience, then we look to intercompany experience. If we are breaking new ground, such as determining an ultimate lapse rate for universal life, then we design the product so that the unknown factor has as small an effect as possible. When there is a seemingly random variable, such as interest rate fluctuations we use a conservatively weighted stochastic model to identify an acceptable minimum probability of adequate profit.

Our basic computer pricing technique includes a standard asset share technique to identify the lapse risk at various durations and a slight refinement of this technique to calculate a return on investment (ROI) over an appropriate period of years. The latter calculation is carried out using several definitions of reserve and, hence, surplus investment. On top of this, we run corporate models which allow the evaluation of an overall financial plan, especially with respect to surplus management. Previously, a separate modeling process was used to estimate tax liabilities and, hence, derive appropriate tax loads which were fed into the basic ROI calculations.

The minimum ROI figure can't be allowed to be less than the currently available return on risk free investments such as Treasury bonds or on other relatively risk free, but higher yielding securities. Determining an appropriate period of measurement is more subjective and is a function of the lapse assumption. Ideally the ROI is relatively constant after a few years.

Insurance policy values are improving in a manner that is inconsistent with changes in pricing assumptions. Increasing interest rates allowed the average actuary to be a hero throughout the 60s and early 70s. We didn't even have to attack the agent's compensation, to any great extent. In the last two to three years, however, improving investment returns, at least for new money products, can't be the explanation for

improving policy values. And I would guess a majority of the established mutuals are even finding their portfolio rates stabilizing. While commissions have been reduced most companies are still keeping their agency organizations afloat. I therefore assume if mortality assumptions improve much more, we will need to replace Whole Life with Endowment at 145!

Consider the following data derived from Best's Review's universal life studies of November 1983 and May and November 1984. The data refer to twentieth-year cash values at the current interest rates with November 1983 as a benchmark:

	Nov. 83	May 84	Nov. 84
Top 10	100	105.93	119.13
Top 20	100	105.38	118.60
Top 30	100	105.39	118.40

We see a nearly 6 percent improvement in the first six months followed by more than 12 percent in the following six months. Interest rates rose from mid-1983 to mid-1984, but my study shows that these improvements would be significant even excluding interest rate gains. In November 1983, the twentieth-year cash values for the top ten products were 63.7 percent of gross premiums accumulated, this improved to 70.4 percent six months later and to 73.1 percent by November 1984. This may be a laudable and overdue increase in benefits to the policyowner, but can these types of product improvements be sustained? Can companies reasonably expect to meet current values?

Consider some of our assumptions. Issue expenses must be subject to inflation. Certainly at my company our new business increases tend to be derived from increases in policy size rather than increases in the number of policies issued. Therefore, we can't expect economies of scale. Admittedly, we are forced to be more aggressive on medical requirements, perhaps leading to reduced unit costs, but surely also leading to increased mortality.

Maintenance expenses suffer from inflation and heavy lapsation which have caused some companies' in-force block to be reduced, according to policy counts.

Other expenses suffer from inflation and a possible contracting in-force policy count which are added to the cost of the developmental projects that are necessary to accommodate the accelerating change. The cost of actuarial help is not insignificant when one group is designing a product every twelve minutes. The marketing department needs to provide support material of increased sophistication, but reduced time horizon. Many of you know that the legal profession is anxious to defend the innocent consumer and it may be that back-end loads will become as popular as personal injuries, especially with often inadequate

proposal systems. My company has already been subject to litigation because of allegedly poor proposals.

We generally need to estimate sales volume as we design a product expense assumption, and this will assume a certain competitive position. Should we estimate the competitive position in six months, when the product is for sale and assume 6 or 8 or even 12 percent improvements? If the competition moves faster than anticipated, sales volume and unit costs may suffer.

Mortality has been a mainstay of product improvements. Many companies, not including mine, are projecting experience. Where do next years improvements come from?

I find I can be reasonably competitive on nonsmokers, but according to our competition center, our smokers' numbers are in left field. We generally assume smoker mortality to be well over 200 percent of nonsmoker mortality. A recent detailed universal life study revealed that to be equally competitive on smokers versus nonsmokers, this ratio would have to be more like 160 percent. The Society Task Force on Smoker/Nonsmoker mortality developed experience-based ratios which peaked at 250 percent at age forty-five for males. I know that the data was not really sufficient and may not reflect a number of current factors, but I doubt that 250 percent can be juggled down to 160 percent on any basis. Of course, it could be that some companies still subsidize smokers with nonsmokers, in which case I am impressed by their skill at providing highly competitive nonsmoker rates.

Based on the first six months of 1984, replacements accounted for 45 percent of new premium according to the Life Insurance and Market Research Association (LIMRA). Poor persistency can cause antiselection. I price for antiselection caused by poor persistency in term products but not in permanent products. How many of us are pricing our smoker mortality to allow for deterioration caused by insurable quitters reapplying or requalifying for a nonsmoker rate? We make a modest allowance.

According to a National Association of Life Underwriters (NALU) study, the average term policy lasts slightly less than two years; half the policies that lapse do so in the first year and 80 percent lapse prior to the third year. Admittedly, conversions mitigate these statistics in some situations. Last October, Best's Review showed a median lapse ratio of 14.9 percent for all insurance products, which represented a slight increase from 1982 to 1983. Many of us assume that lapse ratios are ready to settle down. I believe that universal life created a short-term zig in lapse rates and a zag can't be far behind. Low premium universal life does not seem to be a product which promises high persistency. Certainly, the LIMRA replacement statistic implies that 1984 will not prove to be a banner year for persistency. If interest rates decline, we may see agents "obliged to protect their clients" by replacing universal life with portfolio rate par plans based on 1980 Commissioners Standard Ordinary Tables and high interest guarantees. Companies are leaping into the trough of guaranteed issue replacement. I hope they have priced for their guaranteed issues.

Try replacing select mortality with "select plus five" for example. At issue ages above fifty, ratebook underwritten premiums will probably be deficient by 5-20 percent!

Vanish is a buzz word for par and interest sensitive plans. Try pricing universal life assuming that only five premiums will be paid, a premium lapse situation. The client may continue to respond to a billing despite an original vanishing premium illustration, but the agent will be anxious to divert the potential sixth-year premium to a more usefull (and commissionable) direction. Could this be vanishing profit rather than vanishing premium?

Pricing for federal income taxes is a problem of incredible proportions. It is hard enough to figure out the impact of DEFRA, but simultaneously we are threatened by a multitude of woes by the former Treasury secretary. It seems quite likely that there will be further tax legislation and that the budget deficit will lead to bad rather than good news. Yet there are products on the street which seem to include explicit modest tax loads and guarantee these tax loads for the duration of the policy. Perhaps somebody can explain this optimism?

Last, we must consider the conundrum of interest rates. It is not appropriate to delve into the various interest rate risks, that would be worth several sessions in itself. But, it appears that universal life products were being subsidized in the fourth quarter of 1984, with respect to interest. There were lots of good explanations:

- This is a new investment portfolio product.

- This is a short term promotional expense.

- There is not much cash value in the pot.

- Junk bonds still yield 13 percent plus.

All this is true. Perhaps insurers can afford subsidized products. Perhaps lapse rates will fall. Perhaps projected mortality will be experienced. Perhaps.

I contend that change is knocking at the door of many of our head offices. We can't keep relying on "perhaps." Soon the product development process must return to the real world.

MR. STANDLEY HOCH: We are currently operating in a volatile environment. To see how life insurance companies have adapted their pricing of individual life products to this rapid pace of change, a survey of pricing assumptions, methodology and objectives was conducted.

The survey focused on the approaches that companies are taking towards setting pricing assumptions for the current generation of whole life products. Included in this category are participating products that are currently on the market, general account based universal life products, excess interest whole life products and indeterminate premium

products.   This survey was sent to the pricing actuary at fifty of the largest life insurance companies.   These companies were selected based on total assets and the fraction of those assets supporting individual life business.   The group was evenly split between stocks and mutuals and included several Canadian companies.

The survey itself was made up of a series of questions designed to characterize each company's approach to pricing individual life products in an uncertain environment.   The questions dealt with selection of pricing assumptions, evaluation of pricing risks, and the setting of profit objectives.   In referring to pricing assumptions we mean experience assumptions used in asset share projections for the product. These assumptions are usually different that the assumptions used to develop premium, dividend, and cost of insurance rates.   A set of possible responses was provided for each question, although in several cases, respondents chose to write in other answers.

Of the fifty questionnaires sent out, thirty-two were returned in time to be included in this presentation.   Of these:

- Eleven are stock companies with assets under five billion dollars.

- Five are stock companies with assets over five billion dollars.

- Five are mutual companies with assets under five billion dollars.

- Eleven are mutual companies with assets over 5 billion dollars.

The answers to each question in this survey were summarized for each of these four groups of companies.   A complete set of answers is shown in Exhibit 1.   I would like to focus on the responses to a few of the questions.

PRICING ASSUMPTIONS

Mortality

The first group of questions dealt with the experience mortality assumption used by the companies in their asset shares.   For most companies this is their best estimate of future mortality experience. Most of the companies responded that the source of their mortality assumption is based on their own experience.   Some of the companies use overall industry averages adjusted to reflect company experience and three of the smaller companies use industry average experience.

Most companies are assuming that current experience will continue into the future.   Four out of the five large stock companies and two of the eleven large mutuals indicated that they reflect future improvements in mortality in product pricing.   Only three companies – all of them stock – indicated that they provide for deterioration in ultimate mortality.   Although it is generally accepted that overall mortality will continue to improve in the

future, there is some concern that antiselection by policyholders
will lead to deterioration in insured mortality experience at later
policy durations. Briefly, there is concern that impaired lives may
be less likely to lapse policies than healthy lives leading to
deterioration in the overall mortality experience of a closed block of
policies. A related concern arises when the policyholder is able to
control the net amount at risk under the policy. A universal life plan
at a low premium level will have a net amount at risk that is virtually
constant for a long period of time. At a high premium level, the net
amount at risk would follow the pattern typically associated with whole
life insurance. There is concern that impaired risks would be more
likely to pay low premiums and use the universal life plan like term
insurance, thus giving disproportionate weight to the mortality
experience on impaired lives in the overall average for a block of
business.

Another question dealt with the variables which influence the
mortality assumption. As might be expected, virtually every
company uses a select and ultimate scale. In addition, virtually
every company has separate mortality assumptions for males and
females and smokers and nonsmokers. Two other factors which
may affect mortality - policy size and degree of underwriting - are
recognized by slightly more than half of the stock companies and
slightly less than half of the mutual companies.

Surrenders and Lapses

Unlike mortality experience, which for permanent products has
been relatively stable to date, the lapse experience of the last few
years has been very unusual. Recent high lapses are due in part
to the replacement of traditional fixed cost insurance policies with
products that reflect current investment yields and mortality
experience. In addition to the replacement of permanent insurance
by other forms of permanent insurance, consumers have
surrendered or taken out policy loans in order to move their
savings from permanent insurance to other investment vehicles.
Finally, one might question whether consumers will continue to
view the premium payments for life insurance as an obligation or
as a discretionary expenditure.

The majority of the companies have used their own experience to
develop current lapse assumptions. Several companies use
industry experience or adjusted industry experience as a basis.
Nine of the companies were honest enough to admit that their lapse
assumptions are, in part, speculative. This reflects the fact that
most companies are assuming that lapses will never be as low as
historical experience, and they are hoping that lapses won't
continue to be as high as recent experience.

When we asked companies whether they are reflecting the recent
high level of policy lapses in their pricing assumptions, most of
the companies answered "to some degree." Several answered "not
at all," and only three answered "fully."

Like the mortality assumption, most companies vary their lapse assumption according to the policyholder characteristics. All of the companies varied the lapse assumption by policy duration. A majority of the companies also varied the lapse assumption by issue age. Less than half of the companies use sex or policy amount to vary lapse assumptions. Three companies varied lapse assumptions between smoker and nonsmoker classes.

Expenses

All of the companies surveyed use expense factors based on internal studies. The majority use fully allocated expenses, although a significant number use something less than fully allocated expenses in pricing. One company characterizes its expenses as an average of marginal and fully allocated. Another company uses "close to marginal" expenses in its pricing. A majority of the stock companies include inflation factors in their per-policy expenses. The majority of the mutual companies do not include any inflation adjustments.

In our experience, some companies are reducing pricing expense factors in anticipation of reductions in actual expenses. Of course, it is much easier to reduce pricing expense factors than it is to reduce corporate expenditures. It should be emphasized that over the long term it is only those companies which can support the reductions in expense factors with true expense reductions that will be able to remain competitive and profitable.

Investment Yield

The final pricing assumption is the investment yield. The awareness of the companies to the need to match investment strategies to product liabilities is demonstrated by the fact that only five companies were unable to specify the mix of investments that is assumed in setting investment yields. Twenty-five of the companies responded that their yield assumption is comparable to the yields on high grade industrial bond issues. Five of the companies used the yield on government issues and the remainder used an average new-money rate provided by the investment department.

The second element in determining investment yield is the maturity structure of the portfolio. The majority of the stock companies characterized the average portfolio maturity for new investments as three to five years, while the majority of the mutual companies use sixty to nine years. Two stock companies were less than three years and two stock companies were over ten years. The remaining companies had maturity structures which varied by product.

In addition to taking a more prominent role in setting investment strategies, actuaries have become concerned about the effect of investment risks on future profits. The majority of the larger stock companies and most of the mutual companies make some provision

for the risk of asset default in product pricing. Companies'
treatment of market value and reinvestment risks is much more
varied. The majority of the companies felt they were making some
provision for market value risks in their pricing. However, there
was no consensus on the best method for reflecting these risks.
Eight companies reported that they project cash flows to test the
matching of assets and liabilities. An equal number reflect these
risks by increasing profit or investment margins for their
products. Ten of the mutual companies rely on future dividend
adjustments to insulate themselves from market value and
reinvestment risks. Only three of the companies make no
provision at all for these risks.

METHODOLOGY AND OBJECTIVES

Profit Objectives

The second area of the survey focused on how companies are
measuring the profitability of their life insurance products.
Companies were encouraged to provide more than one response if
more than one profit measure is considered in product pricing.
The favorite measurers of the stock companies are profit margin,
the present value of profits as a percentage of premium, and
internal rate of return. Internal rate of return is also used by a
majority of the mutual companies as are break-even-year,
first-year strain, and accumulated-surplus objectives.

As expected, the majority of the companies continue to base profit
objectives on statutory accounting standards. More than half of
the companies also use some other form of accounting system,
either GAAP or an internal management accounting system, to
report profit objectives. Surprisingly, ten of the mutual
companies are using alternative accounting measures while only
seven of the stock companies use these measures.

Methodology

The new tax law, by eliminating the multiple-phase tax system,
allows companies to reflect marginal taxes in a more
straightforward manner than under the 1959 Act. Perhaps as a
reflection of this fact, twenty-seven out of the thirty-two
companies surveyed indicated that they include a provision for
federal income tax in product pricing. The five companies which
do not include federal income tax were all stock companies. Of the
twenty-seven companies which include federal income tax,
twenty-three base taxable gain on an exact calculation of tax basis
reserves. In practice, this is a burdensome procedure,
particularly for universal life policies valued using the new
Commissioner's Reserve Valuation Method (CRVM) method. In this
case, approximate reserves will produce reasonably accurate
results.

In calculating federal income tax, mutual companies face the
additional problem of allocating the tax on surplus. Most of the
mutual companies indicated that this tax is allocated based on the
products' year by year contribution to surplus. Two companies

allocate the tax on an average basis over the life of the product, and several companies are either not recognizing the tax or have not decided how to recognize it.

Many stock companies use return on investment as a profit measure, and most mutual companies explicitly provide for a temporary contribution to surplus in product pricing. This may be thought of as a contingency reserve built up over the life of the product which decreases to zero when all of the policies are off the books. With the exception of the smaller stock companies, over 80 percent of the companies use benchmark surplus or a temporary contribution to surplus in their product pricing.

In addition to a temporary contribution to surplus, some mutual companies include a charge in their asset shares for a permanent contribution to surplus. As the name implies, this contribution is not returned to policyholders. Instead it serves as a long-term provision for adverse fluctuations in experience. All of the smaller mutuals and seven of the large mutuals indicated that a permanent contribution is included in their pricing systems.

The use of probabilistic or stochastic methods to test profits has received much discussion in recent years. Traditional pricing methods use deterministic methods to predict future profits. For revenue and expense items which are under the control of the company, this is appropriate since presumably these elements will not be subject to random fluctuations. However, such elements as mortality and interest rates are not susceptible to control by the company and are widely assumed to be subject to random fluctuation to some degree. Techniques to use stochastic methods to measure both mortality and interest rate risks require large amounts of computer time and a level of effort which may not be compatible with the product development cycle in many companies. Twenty-six of the thirty-two companies in our survey indicated that they do not use stochastic methods in product pricing. However, four of the companies have used stochastic methods to measure market value and reinvestment risk, and three of the companies use stochastic methods to measure mortality risk.

MR. BRITTON: The survey shows that we are making some changes in pricing assumptions. Companies are not projecting mortality improvement. They are beginning to make some provision for interest rate risks. They are using "crystal ball" or speculative lapse rates, and they are anticipating some improvement in pricing expense factors. With the same survey five years ago, we would have found companies projecting mortality improvement, ignoring interest rate risks, assuming a continuation of the historical low level of lapse rates, and pricing with actual expenses.

MR. MICHAEL DAVLIN: Some new techniques from the field of decision analysis are being used in other fields to evaluate risk and uncertainty. Decision analysis is a cyclical process. It starts with prior information. It involves building a deterministic model to represent what can happen in the future under different possible sequences of events. Then,

probabilities are assigned to these potential outcomes. Finally, you can evaluate the information that you have. Then you can make a decision and act, or you can get more information and cycle through the process once more. There are techniques, in fact, for determining the value of the search for additional information.

Because this is a bit complicated, an analogy that fits reasonably well is the technique for flying an airplane. One of the first rules you learn as a pilot is that it's fine to fly by feel. A pilot eventually feels more like he's flying rather than that he's flying an airplane. However, when you hit a volatile environment or stormy weather, the cardinal rule of being a pilot is to rely on your instruments. You might feel like you are flying upside down or in circles, but if the instruments say you are on course, then you are on course. And so, the purpose of the analogy is to try and convince you that you might need instruments.

Another analogy is that of traveling with a compass. A compass works pretty well with the right environment, but if you try traveling with a compass near the North Pole, you might find that you do not go in the direction in which you thought you were going to go.

A three-hundred-year-old scoop you might be interested in is that Isaac Newton, in 1686, stated that an individual's age should have no bearing at all on the price of a life annuity. This is an example where an exceedingly fine mind can make a real mistake when dealing with probability.

To introduce the techniques of decision analysis start with two formulas for a net single premium for a life annuity, as shown in exhibit 2. I picked annuities for two reasons. They are extremely simple, and my company is applying these techniques to structured settlements.

I labeled the formulas "Traditional" and "Modern." They are both old formulas, but the "Modern" label is because this formula forms the basis for the new life contingency work by the education committee. The other formula is the more traditional approach to calculating annuity values. Both formulas give the same results under the same set of assumptions. Anderson's method, the pricing method most of you use today, is based on the traditional formula. Anderson's method looks at a given year and develops average costs for benefits resulting from the different events during that particular year.

The modern formula represents a different approach. It considers all the possible outcomes and evaluates the financial consequences of each. The average cost is the sum of the products of the cost of each event times the probability of that particular event occurring.

Looking at the probabilities in each approach, the traditional formula uses a life cohort that's usually viewed as a deterministic model. It's an average cost model. You could test different scenarios if you wanted to, but it's not a question that naturally arises from that particular formulation.In the modern formula, the probability is the deferred probability of death.

One difference between these two models, and the reason the new life contingency model uses the modern approach, is that the probabilities in the modern formula sum to unity, so it's a probability distribution function.   The probabilities in the traditional formula don't do that. One advantage to the modern formula is that if you've got a probability distribution function you cannot only look at expected values, but you can start incorporating some risk analysis. The new contingencies book stresses that.

For interest rates in traditional methods calculate the present value of benefits paid out to the survivors in each duration.   The interest rate used was typically the assumed earnings rate.

The modern formula is basically the same thing, except that now instead of looking at the present value of benefits at a particular duration, one looks at the present value of benefits assuming a particular outcome or termination of the contract.   One interesting insight here is that the possible present values or possible costs under the contracts are represented by an annuity certain factor.   That may not even match up to the average cost for the traditional method.   This is the same as saying that if you flip a coin, the expected result is half a tail and half a head.

A third formulation, shown in exhibit 3 called "Decision Analysis," is part of a decision analysis model.   This takes the annuity factor and breaks it into an accumulated annuity factor and a discount factor. This is a formula that might be relevant if you were going to buy an annuity yourself.   The annuity factor reflects the accumulated value of benefits if you died in the nth duration.   That would reflect an accumulation rate.   Another interest rate is used to discount back to issue.   This is the personal time preference rate.   We've got two different interest rates representing two different things.

An insurer would be interested in its expected gains.   The price you charge is going to grow with interest up to the nth duration at the accumulation rate.   You then subtract the accumulated benefits and discount that difference back to the issue date at the opportunity cost rate.   Because the probabilities are a statistical distribution function the result represents an expected gain.

If these assumptions match Anderson's traditional model, then the expected gains under the two approaches are the same.   The modern formula assumes that no money is paid out in dividends to policyholders or shareholders until the contract is terminated.   If you paid dividends to either shareholders or policyholders as money became available for distribution, you would match Anderson's method.

If you match Anderson's method, why should you go to all the bother of redesigning the model?   When the financial impact of each possible outcome is identified, I can identify any basic flaws in the structural design.   In our early development of back-end-loaded universal life products, we were using a traditional approach.   We found a design that we thought was profitable but then we decided to analyze it this way.   By doing this we discovered something that with twenty-twenty

hindsight seems awfully simple. Almost all of our profits came from assuming there were going to be lapses during the durations in which the surrender charge was rapidly amortizing. This wasn't a very likely circumstance, so we redesigned the plan.

One trap we fell into at that time was to think that management ought to be aware of all the different outcomes that were possible. So we started flooding management with information. They decided they didn't like that and insisted on weighted results, so we went back and started reporting weighted results again. We didn't even look at them at the policy design or middle level in management. And we made another obvious error. By pricing a plan with a quick-pay feature on a weighted basis with weighted premiums, we got what we thought was an acceptable future profit margin. Then we turned the plan over to our agency department to develop an illustration system. They hit upon quick-pay as it was an extremely competitive sales illustration. We got a little nervous and went back and repriced the plan. On a quick-pay basis we nearly lost our shirts. That's one point in favor of the modern approach.

We have started to apply this technique to structured settlements which we got into about nine months ago. We started to become a little bit concerned about whether the approach we were taking was going to compensate us adequately for the risks on large contracts. We took the first step in the decision analysis model and identified the possible outcomes. For the annuity model, either death or survivorship occurs in each duration.

In addition, we developed a fairly full-blown and sophisticated asset model for this product. For each net cash flow we have an investment strategy. We map each cash flow onto hypothetical assets that might be of different duration and yield rates than the cash flows in other durations. In every duration we have an assumed yield curve and are able to evaluate the possibility that if the individual dies, we're able to pocket whatever gains we have. We go to the yield curve and calculate market values for the assets in the models. Applying this to a life insurance plan is the first step towards developing a feel for market value risk and for allocating the perceived cost of guaranteed cash values back to the proper policyholders - assuming the market will let you. You might find out that there are some markets you just don't want to be in.

The model can be further enchanced to develop risk-adjusted capital value. This is like the present value of profits except it is adjusted for the perceived cost of risk. This model reflects all of the possible outcomes. It incorporates things like speculative assumptions about lapses or premium patterns. It reflects our own desired yield and also incorporates our attitude towards risk. This is something we couldn't do with our weighted model. With this particular model, the risk adjusted capital value acts as a minimum hurdle for decision making. If it turns out to be greater than zero, then it's a go, if it's less than zero it's a loser.

Decision analysis demonstrates that basically there are two types of volatility. One is when you have new or unimaginable possible outcomes. That's different than the volatility that comes when you've got a fixed set of possible outcomes but are uncertain about assessing the probability of each.

MR. BRITTON: Mr. Campbell, in your new role as a distributor, will you be so adamently opposed to matching the competition as a pricing methodology?

MR. CAMPBELL: The agency that I work for sells employee benefits to large companies, not "mom and pop" businesses. To do this takes a period of months or years and generally involves a fair amount of income for the consulting organizations that are represented in this room. My function will be to negotiate with the consulting organizations to ensure that the products which we are selling and the benefits which we are proposing are sound. An inadequately priced product is will seem competitive to the lay client. My objective would be to help a company sell benefits with sound funding. This is made difficult when there are products floating around that aren't appropriately designed.

MR. BRITTON: Mr. Davlin, what are the mechanics of moving from a traditional pricing system, like Anderson's method, to the approach that you're taking now, in terms of software development or repositioning of management thinking?

MR. DAVLIN: We tend to use IBM personal computers for our pricing, so it's really a pretty easy matter to develop the software to price in this manner. The programmer we're working with has developed pricing models under both approaches, and he said the new approach is a lot easier for him to understand. The fact that the Society is going to be educating actuarial students in the new approach is in its favor. You have to understand probability, expectation, present values and accumulations at interest to use the pricing program. You don't have to get into the more complicated asset share concepts that used to come much later in the actuarial education process. As far as changing management thinking, in the short term you're going to have to continue to report profits as you always have. It will be through an evolutionary process as the management ages and becomes familiar with these ideas that you can move away from expected value reporting to risk-adjusted cost reporting. There was an article on this in the Transactions, Volume XXXV, called "REROSHE: The Concept of a Risk-Free Equivalent Return on Shareholder Equity."

MR. DOUG ECKLEY: Mr. Davlin, I'm unclear how you could include premium suspensions with universal life in your model. Would you have to say that a lapse in year ten is really ten possible outcomes corresponding to the ten possible years of premium suspension?

MR. DAVLIN: You would build outcomes that have the different premium patterns at which you want to look. A lapse in year ten conceivably would reflect ten different premium patterns, if you thought it was of value to go into that fine a detail in your analysis.

FROM THE FLOOR: When people in the survey said they used marginal costs or fully-allocated costs was it possible to determine what decision they were making? If you'd already made the decision that you were going to write new business this year then it makes sense, at least in my company, to price some products marginally. But if we're making the decision as to whether to stay in the life insurance business then all expenses are marginal and we'd fully allocate. I was wondering if there are other companies that straddle the fully-allocated and marginal expense allocation methods depending upon the particular decision.

MR. HOCH: The results showed that almost everyone selected the fully-allocated expense category. We provided a continuum of possible answers to allow for using something less than fully-allocated expenses. The point that wasn't clear from the survey was whether the total expenses that were being allocated would correspond to the company's current budget plan or if they would reflect a budget to which the company currently was in the process of moving.

MR. MICHAEL HEALY: I've been a pricing actuary for about five years and what I've seen happen in the marketplace that I operate in is not particularly sophisticated. As actuaries we can have sophisticated models and techniques to price products, but what's been swaying the marketplace has been the products such as graded-premium and select-term products. I'm just wondering if we're not fooling ourselves with all these sophisticated techniques when in our day-to-day activities we are actually heavily impacted by marketing decisions. I don't have a solution, but the companies I have worked for either price their products irresponsibly or lose their market share.

It makes sense to me to have the pricing actuary look at the products priced in the last year and if one segment has taken off then you are in trouble in that one area. There are brokers that have got the sophistication that we've got and it is a dollars-and-cents value to them to pinpoint weaknesses in any company's portfolio.

MR. BRITTON: Those of us who have been around long enough to have priced in a noncomputer environment have found that in producing a rate book, agents were always very quick to discover the holes. You would find out later that a particular product was being sold in a particular manner. After your initial flush of success, you discovered you were losing your shirt on it. Computers allow the market to determine vulnerability in your pricing very quickly. The structured annuity market is perhaps the most efficient market pricing mechanism I've seen in the insurance industy. A broker will have a computer disk containing the rate structure of a number of companies, and for a particular pattern of payments, it's the equivalent of doing an illustration on each company's disk. You have to be the lowest priced of a couple of dozen companies. People who have good success in structured settlements either really know what they are doing or don't know what they are doing at all, and I'll let you be the judge.

MR. WILLIAM ARNDT: Mr. Davlin, I'd like to know if you've ever employed the risk-preference measurement tool in your rating scheme. If so, whose risk preference have you measured?

MR. DAVLIN: When you say rating scheme, I assume you are talking about pricing. Four to five years ago when we developed our first universal life product, I used it behind the scenes - we were still reporting expected profits to management. We developed a utility model that we thought was appropriate called an exponential model. Decisions were based on the moment-generating function of the claims distribution. We determined the risk preference by looking at prices at which we were willing to issue term insurance at our maximum retention limit of $1,000,000. We then developed a risk cost for the term portion of the universal life insurance product. Also, we talked to the investment people and asked them at what margin they would be willing to take different risks. We wound up with just an asset management fee. We priced under many different scenarios and under each would include things like premium patterns and interest rates so we would calculate a risk premium for the investment side of the contract and one for the term side. We'd take the present values of those premiums and subtract them from the typical present value of future profit and developed a risk-adjusted basis. We reported the expected profit and the tentative product design to management. We have also used it in reinsurance to a small degree to price stop-loss premiums.

MR. JAMES MERWALD: I was surprised that virtually no companies have started employing the stochastic method in their pricing. Are they relying on sensitivity testing where assumptions are varied by a certain percentage one way or the other and give some comfort that they are not going to lose money under various scenarios?

MR. DAVLIN: Companies have developed some degree of comfort from scenario testing. There is a problem with using a simulation model, especially on the asset side. When you take scary results to your investment department, they dismiss them by modifying the portfolio to mitigate the losses. Right now we take the model discussed earlier and show the investment department the evolving experience for a one to two year period. We then let them reset the investment strategy.

MR. BRITTON: Frequently the investment modeling on annuity products, universal life products, or interest-sensitive products bears little or no relationship to the actual investment practice. This has been true in companies where modeling looks good but the portfolio invested, the maturity, the quality, shows little relationship to the model.

Mr. Davlin, to what extent does your decision analysis technique replace the sensitivity testing? Is it a method that will do what the sensitivity testing historically has done?

MR. DAVLIN: The decision analysis technique is an extreme form of sensitivity testing. To sensitivity test your vulnerability to lapse assumptions, you might increase the lapse assumptions in a particular duration. By looking outcome by outcome I have just moved the assumption all the way to 100 percent for either death or withdrawal or surrender or maturity. The greatest potential value of scenarios is that they reflect the cost of risk in a systematic way. As an actuary, I would hope that quantifying some of the perceived risk will allow us to

get the product margins back up. It's tough to price in a very disciplined way when any fly-by-night company can come by and undercut you. Somebody could take a flier and come out with a product with a low rate and if it works out they benefit, if it doesn't work out we pay the cost.

MR. FELIX SCHIRRIPA: I am involved with pricing pension products. The survey shows that most companies are not subsidizing the business. However, I see examples of subsidies every day in my business. It's common, to see companies quoting 12.5 and 13 percent credited interest rates. Pricing with these kinds of rates is equivalent to giving away your company's quality rating.

MR. EDWARD COWMAN: Fifty companies with thirty-two responses isn't a very large sample. Are these only Tillinghast clients?

MR. STAN HOCH: We took the listing that Best's provides periodically of the companies ranked by assets and worked our way from the top of that list for both mutual and stock companies eliminating any company with life insurance reserves of less than 10 percent of total assets. In that fashion we worked down the list until we looked at about seventy companies. Of those, fifty met the selection criteria.

MR. COWMAN: What characteristics did the top fifty or seventy companies represent?

MR. HOCH: They were U.S. and Canadian life insurance companies, not as corporate groups but as statutory entities.

MR. COWMAN: These were ranked by size, by rating?

MR. HOCH: They were ranked by dollars of assets. They are the twenty-five largest stocks and the twenty-five largest mutuals which write a significant amount of individual permanent life insurance.

MR. WILLIAM ARNDT: Mr. Davlin, there's a good deal of talk about pricing on the basis of random variation. How does this tie in with the finance people's inclination to ignore random variation and their belief that the real risk is what they call market risk or systematic risk?

MR. DAVLIN: Either risk, whether it's a random risk or a systematic risk, could be reflected in a mathematical model of possible outcomes. The risk and decision analysis relates to the fact that people tend to be risk adverse and different individuals have different attitudes towards risk. If you spent the time developing a model incorporating your particular attitude toward risk, you would come up with risk premiums that would reflect those two risks.

MR. ARNDT: One could argue that investors in a company could always diversify through investments in other companies to spread their risks. So a company's management shouldn't be focused so much on random variation. If the investors in that company don't like the random fluctuations that affect that particular industry, those investors can and probably should diversify in other industries. If we take

random variation in our pricing into account, we may be setting premiums so high and thus too conservative. In my experience none of the models take the price elasticity of demand into account and ignore the risk of losing out to the competition. The models assume that we offer a product at a price, and people take it; we don't care about volume projections. In twenty years, I've never seen an actuarial model that took pricing elasticity of demand into account.

MR. DAVLIN: We are starting to do that. We are talking to the marketing people and saying if the price was such and such, the commission rates were at a certain level, how much could you sell? It's not quite contract between the marketing side and the underwriting side, but at least it's a commitment made by upper management. We now reflect demand elasticity in pricing and in our expense factors. I agree completely with your comments about pricing for risk when investors can diversify. But the other two parts of the picture are the risks faced by the customer and risks faced by the employees of an institution. Finance theory would tell you that in order to have an optimal arrangement between all three parties, it is efficient for the institution to act as though it were risk adverse.

MR. JEFFERY T. DUKES: One point that you brought up was that the price depends on how much you sell. If you treat lapse rates and mortality rates as random variables, and you look at an aggregation of policies, the more you sell, the less your risk in a given situation. You can put some onus on marketing people if they want a very competitive product. They have to sell a lot in order for you to justify the risk that you're taking. If they don't sell very much, then there's much more risk, although if you don't sell very much you can't lose very much either.

Some of the companies we've been looking at recently in our work aren't making the investment spread that they thought they would on things like universal life. It might be worthwhile to check out what the investment people are telling you. One company was making a lot more than they thought, which was good for them. In another case it was just the opposite.

Also, looking at different types of risks, mortality and lapse risks can be treated like random variables. They affect individual policyholders and to some extent can be assumed to be independent. Things like investment risk affects the company as a whole. You have to deal with that risk by coming up with an investment strategy which protects you against various outcomes in the future in terms of the yield curve and lapsation. You have to do a fair amount of simulation testing. You can't treat investment risk in quite the same fashion as lapse and mortality.

MR. DAVLIN: The investment risk really has to be modeled at a higher level than either the lapse risk or the mortality risk.

MR. CHARLES PICARD: I found it interesting that a number of small stock companies are using somewhat low-grade investments to determine their future investment yield. I wonder whether this is a trend, and whether they take the default risk into consideration.

MR. DAVLIN: Morgan Stanley just released a study on that topic. It analyzed the market premium for so-called junk bonds and looked at the default experience. The conclusion of that study was the same as the conclusion that Drexel Lambert came up with, that is, the market is inefficient when it comes to junk bonds and there is a sizable premium that could be gained by moving into junk bonds. Of course, that still raises the question of whether the market is more efficient now that information has been released. Prospectively, the margin may not be there.

MR. CAMPBELL: Interest rates paid on universal life or other interest-sensitive products are going to come in line with interest rates that are being earned. If companies are not going to downgrade their rating, that process of coming in line ought to happen fairly quickly. If we were to extrapolate the interest-rate patterns it's going to be hard to earn what some companies are paying.

MR. BRITTON: I would like to believe that interest credited and interest earned are going to come into line and provide companies with the margins they've anticipated in their pricing. However, I've seen evidence to the contrary so far.

EXHIBIT 1

PRICING SURVEY QUESTIONNAIRE AND SUMMARY OF RESPONSES

This is a survey of the approaches that companies are taking towards setting pricing assumptions for the current generation of whole life products. Included in this category are participating products which are currently marketed, general account based universal life products, excess interes whole life products and indeterminate premium products.

Setting pricing assumptions for these products is a challenge, due to the changing economic environment in general and the rapidly evolving marketplace for life insurance products in particular. What follows is a series of questions designed to characterize your comany's approach to dealing with these uncertainties. The results of this survey will be summarized and presented at the 1985 spring meeting in the panel discussion titled: "Pricing Assumptions in a Volatile Environment." A summary of results which does not identify individual companies will also be mailed to each respondent who requests a personal copy.

Here and in the survey itself, when we refer to pricing assumptions, we mean the experience assumptions used in the asset share projection for the product. These assumptions are usually different than the assumptions used to develop premiums, dividends and cost of insurance rates.

After each question, several possible answers are listed. Please feel free to insert a different answer if none of the choices correctly describes your current practices.

Your contribution to this survey will help to make it a valuable source of information on the "state of the art" in product pricing. Thank you for your time and assistance.

EXHIBIT 1 (CONTINUED)

PRICING ASSUMPTION SURVEY

I. Company Data

A. What is the ownership structure of your company?

_____ Stock
_____ Mutual
_____ Stock subsidiary of a mutual

B. What size is your company?

_____ Over $5 billion assets
_____ Under $5 billion assets

II. Pricing Assumptions

A. Mortality

1. What is the source of experience mortality?

_____ Company experience
_____ Industry experience
_____ Industry experience, adjusted for differences between company and industry experience

2. Is provision made for future improvements in mortality?

_____ Yes
_____ No

3. Is provision made for deterioration in ultimate mortality due to increased lapses or cessation of premium payments?

_____ Yes
_____ No
_____ Not applicable

4. Does the mortality assumption vary by any of the following factors? (Check as many as apply)

_____ Sex
_____ Policy duration
_____ Smoker habit
_____ Policy size
_____ Degree of underwriting (nonmedical/medical)

5. Is a margin for conservatism included in the mortality assumption?

_____ Yes, through use of a best-estimate table with loads
_____ Yes, through use of a conservative table
_____ No, a best-estimate table is used

EXHIBIT 1: PRICING ASSUMPTION SURVEY (CONTINUED)

B. Surrenders and Lapses

  1. What is the source for the lapse assumption?

      _____ Industry experience
      _____ Company experience
      _____ Industry experience adjusted for deviations in
               company experience
      _____ Crystal ball

  2. Is the lapse assumption reflective of the relatively high
      lapses recently experienced by the industry?

      _____ Fully
      _____ Somewhat
      _____ Not at all

  3. Does the lapse assumption vary by any of the following
      factors? (Check as many as apply)

      _____ Issue age
      _____ Sex
      _____ Policy duration
      _____ Policy size
      _____ Smoking habit

C. Expenses

  1. What is the basis for pricing expense factors?

      _____ Company expense studies
      _____ Industry averages

  2. Which of the following do expense factors most closely
      reflect:

      _____ Fully-allocated expenses
      _____ Close to fully-allocated expenses
      _____ Average of marginal and fully allocated
               expenses
      _____ Close to marginal expenses
      _____ Marginal expenses

  3. Do expense factors include any provision for inflation?

      _____ Yes
      _____ No

EXHIBIT 1: PRICING ASSUMPTION SURVEY (CONTINUED)

3. What would be the average maturity of a portfolio constructed to reproduce the assumed investment yield?

    _____ One to two years
    _____ Three to five years
    _____ Six to nine years
    _____ Ten or more years

4. How are market value and reinvestment risks reflected in product pricing?

    _____ By modeling asset and liability cash flows
    _____ By including additional margins in profit objectives
    _____ By reducing anticipated investment yields
    _____ No explicit provision is made

5. How is investment income allocated?

    _____ By company
    _____ By line of business
    _____ By plan of insurance
    _____ By year of issue

6. How are credited rates set at issue?

    _____ Primarily based on competition
    _____ Based on projected investment yields, modified for competition
    _____ Primarily based on projected investment yields

III. Methodology and Objectives

A. Profit or Surplus Objectives

    1. Which of the following objectives are considered in product pricing? (Check as many as apply. Please put a second check next to primary objective.)

        _____ Present value of profits as a percent of premium
        _____ Present value of profits per unit
        _____ Break-even year on reserve
        _____ Break-even year on cash value
        _____ Internal rate of return
        _____ First-year strain
        _____ Accumulated surplus

    2. In what terms are objectives stated?

        _____ Statutory accounting standards
        _____ GAAP accounting standards
        _____ Internal management reporting standards

EXHIBIT 1: PRICING ASSUMPTION SURVEY (CONTINUED)

B.   Pricing Methodology

1.   Is Federal Income Tax recognized in pricing?

_____   Yes
_____   No

2.   Are exact reserves used to develop taxable gain from operations?

_____   Yes
_____   No
_____   Not applicable

3.   How is the mutual company add-on tax recongnized?

_____   Year-by-year
_____   Average over life of product
_____   Not recognized
_____   Not applicable

4.   Is benchmark or target surplus included in product pricing?

_____   Yes
_____   No

5.   Is a permanent contribution to surplus included in product pricing?

_____   Yes
_____   No
_____   Not applicable

6.   Which of these risks are tested using stochastic methods?

_____   Market value and reinvestment risks
_____   Asset default risk
_____   Mortality risk
_____   Stochastic methods are not employed

Exhibit 1--Continued

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PRICING ASSUMPTIONS IN A VOLATILE ENVIRONMENT
PRICING ASSUMPTION SURVEY RESULTS

I. <u>Company Data</u>

	STOCK		MUTUAL		TOTAL
A. Ownership Structure					
B. Size of Company ($ Billion) in Assets	<5	>5	<5	>5	
C. Number of Companies Responding	11	5	5	11	32

II. <u>Pricing Assumptions</u>

A. Mortality

	STOCK		MUTUAL		TOTAL
	<5	>5	<5	>5	
1. Source of experience mortality					
a. Company	5	3	2	11	21
b. Industry	2		1		3
c. Adjusted industry	4	2	2		8
d. No response			1		1
2. Provision for future improvements					
a. Yes	1	4	1	2	8
b. No	9	1	4	7	21
c. Varies by product	1			2	3
3. Provision for deterioration in ultimate mortality					
a. Yes	2	1			3
b. No	7	4	5	10	26
c. Not applicable	2				2
d. Varies by product				1	1
4. Factors which vary mortality assumption					
a. Sex	11	5	5	10	31
b. Policy duration	9	5	4	10	28
c. Smoking habit	11	5	5	11	32
d. Policy size	8	3	1	5	17
e. Degree of underwriting	6	3	2	5	16

Exhibit 1--Continued

PRICING ASSUMPTIONS IN A VOLATILE ENVIRONMENT
PRICING ASSUMPTION SURVEY RESULTS

II. Pricing Assumptions	STOCK		MUTUAL		TOTAL
A. Mortality (cont.)	<5	>5	<5	>5	
5. Margin for conservatism					
a. Yes, best-estimate table w/loads	1	1	1	2	5
b. Yes, conservative table	3		1	1	5
c. No, a best-estimate table is used	7	4	3	8	22
B. Surrenders and Lapses					
1. Source for the lapse assumption					
a. Industry experience			1	1	2
b. Company experience	10	4	4	10	28
c. Adjusted industry experence	1				1
d. Crystal ball	4	3		2	9
2. Recent industry lapses reflected in assumption					
a. Fully	2			1	3
b. Somewhat	7	5	3	7	22
c. Not at all	2		2	2	6
d. Varies by product				1	1
3. Factors which vary lapse assumption					
a. Issue Age	8	5	3	7	23
b. Sex		2		3	5
c. Policy duration	11	5	5	11	32
d. Policy size	5	2	1	5	13
e. Smoking habit	3				3
f. Market				1	1
g. Product				1	1
h. Mode of payment				1	1
i. Level of early cash values				1	1

Exhibit 1--Continued

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PRICING ASSUMPTIONS IN A VOLATILE ENVIRONMENT
PRICING ASSUMPTION SURVEY RESULTS

II. Pricing Assumptions	STOCK		MUTUAL		TOTAL
	<5	>5	<5	>5	
C. Expenses					
1. Basis for pricing expense factors					
a. Company expense studies	11	5	5	11	32
b. Industry averages					0
2. Expense factors reflect					
a. Fully-allocated expenses	8	3	2	9	22
b. Close to fully-allocated expenses	2	2	2	2	8
c. Average of marginal & fully-allocated			1		1
d. Close to marginal expenses	1				1
e. Marginal expenses					0
3. Provision for inflation					
a. Yes	8	4	2	3	17
b. No	2	1	3	6	12
c. No response				1	1
d. Varies by product	1			1	2
D. Investment Yield					
1. Grade of investment assumed					
a. Government issue	3	1	1		5
b. High grade industrial issue	9	5	4	7	25
c. Lower grade industrial issue	1				1
d. Current mix				2	2
e. Whatever investment people use			1		1
f. Varies				2	2

Exhibit 1--Continued

PRICING ASSUMPTIONS IN A VOLATILE ENVIRONMENT
PRICING ASSUMPTION SURVEY RESULTS

II. Pricing Assumptions

	STOCK		MUTUAL		TOTAL
	<5	>5	<5	>5	
D. Investment Yield (cont.)					
2. Provision for asset default risk					
a. Yes	3	4	3	6	16
b. No	8	1	1	5	15
c. No response			1		1
3. Portfolio average maturity					
a. One to two years	1	1			2
b. Three to five years	4	4	3	2	13
c. Six to nine years	2		2	5	9
d. Ten or more years	2				2
e. Varies (3-5, 6-9, 10+)	2			4	6
4. Market value & reinvestment risk reflected					
a. By modeling asset & liability cash flows	2	2	1	3	8
b. By including add'l margins in profit objectives	4	2	1	1	8
c. By reducing investment yields	4	1		3	8
d. No explicit provision is made	2	1	1	6	10
e. Future dividend scales			1	1	2
f. Investment generation technique			1		1
5. Investment income allocation					
a. By company	2	1	1	2	6
b. By line of business	8	3	2	9	22
c. By plan of insurance	1	3		3	7
d. By year of issue	1	1	2	4	8
e. By year of investment				1	1
f. By block of issues				1	1

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Exhibit 1--Continued

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PRICING ASSUMPTIONS IN A VOLATILE ENVIRONMENT
PRICING ASSUMPTION SURVEY RESULTS

II. Pricing Assumptions	STOCK		MUTUAL		TOTAL
	<5	>5	<5	>5	
D. Investment Yield (cont.)					
6. Credited rates set at issue					
a. Based on competition					0
b. Based on modified, projected investment yields	8	2	4	2	16
c. Based on projected investment yields	3	3	1	8	15
d. Based on projected dividend rates				1	1

III. Methodology and Objectives

A. Profit or Surplus Objectives

	STOCK		MUTUAL		TOTAL
	<5	>5	<5	>5	
1. Product pricing objectives					
a. PV of profits as a % of premium	8	3	2	5	18
b. PV of profits per unit	4	1	1	3	9
c. Breakeven year on reserve	6	1	2	6	15
d. Breakeven year on cash value	1	1	1	7	10
e. Internal Rate of Return	8	4	3	7	22
f. First-year strain	2	1	3	5	11
g. Accumulated surplus	1		3	9	13
2. Terms of objectives					
a. Statutory accounting standard	8	4	4	7	23
b. GAAP accounting standards	3	2	1	1	7
c. Internal management reporting standards	2		2	6	10

B. Pricing Methodology

	STOCK		MUTUAL		TOTAL
	<5	>5	<5	>5	
1. Federal Income Tax recognized					
a. Yes	7	4	5	11	27
b. No	4	1			5

Exhibit 1—Continued

PRICING ASSUMPTIONS IN A VOLATILE ENVIRONMENT
PRICING ASSUMPTION SURVEY RESULTS

III. Methodology and Objectives

B. Pricing Methodology (cont.)

	STOCK <5	STOCK >5	MUTUAL <5	MUTUAL >5	TOTAL
2. Exact reserves used to develop taxable gain					
a. Yes	8	4	4	7	23
b. No	1		1	3	5
c. Not applicable	2	1		1	4
3. Mutual company add-on tax recognized					
a. Year-by-year	1		4	7	12
b. Average over life of product				2	2
c. Not recognized			1		1
d. Not applicable	10	5		1	16
e. Not decided				1	1
4. Benchmark or target surplus used in pricing					
a. Yes	3	4	5	9	21
b. No	8	1		2	11
5. Permanent contribution to surplus used in pricing					
a. Yes	2	1	5	7	15
b. No	6	1		4	11
c. Not applicable	3	2			5
d. Varies		1			1
6. Risks tested using stochastic methods					
a. Market value and reinvestment	2	1		1	4
b. Asset default					0
c. Mortality	1	1	1		3
d. Stochastic methods not used	8	4	4	10	26
e. Lapse	1				1
f. Expense	1				1
g. No response	1				1

EXHIBIT 2

ANNUITY NET SINGLE PREMIUM TRADITIONAL AND MODERN

TRADITIONAL	MODERN
$$\sum_{t=0}^{\infty} {}_t p_x v^{t+1}$$	$$\sum_{t=0}^{\infty} {}_{t|} q_x \ddot{a}_{\overline{t+1|}}$$

NET SINGLE PREMIUM
$$\ddot{a}_x$$

EXHIBIT 3

ANNUITY NET SINGLE PREMIUM MODERN AND DECISION ANALYSIS

MODERN	DECISION ANALYSIS
$$\sum_{t=0}^{\infty} {}_{t|} q_x \ddot{a}_{\overline{t+1|}}$$	$$\sum_{t=0}^{\infty} {}_{t|} q_x \ddot{s}_{\overline{t+1|}} v_r^{t+1}$$

DISCOUNT FACTOR REFLECTS
THE OPPORTUNITY COST OF
CASH (SUBJECTIVE)