

**RECORD OF SOCIETY OF ACTUARIES
1987 VOL. 13 NO. 4B**

**SELECTION OF SCENARIOS AND
ASSUMPTIONS FOR VALUATION ACTUARY WORK**

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Recorder: STEVEN I. SCHREIBER

- o Use of past trends to analyze the future
- o Means for considering how the past doesn't necessarily extrapolate the future
- o Techniques for assuring that assumptions used within scenarios are internally consistent
- o Use of results in company management
- o How many scenarios and who should choose them?
- o How the external environment should be considered in developing scenarios to be tested
- o Effect of changes in the shape of the yield curve
- o Weighting scenario results

MR. DOUGLAS MENKES: In July, 1987, the Society's Committee on Life Insurance Company Valuation Principles released an exposure draft in which a distinction was made between valuation principles and standards of practice. Rather than including specific standards of practice in the valuation principles themselves, the Committee developed valuation principles to encompass current and future standards of practice.

Our panel will talk about such past, current and future standards. Some of these standards are listed in your program.

PANEL DISCUSSION

MS. SUE W. OGDEN: My responsibilities at The Prudential Asset Management Company, previously known as the Group Pension Operation within The Prudential, include the valuation of liabilities, specifically for the C-3 Risk analysis for New York and, most recently, preparation of a C-3 Risk analysis for management purposes.

What I want to share with you this morning are the techniques and procedures we went through in the pension area to develop the assumptions that we used within those analyses.

The starting point for most of the assumptions is the interest rate scenario. There are a lot more assumptions buried in whatever analysis you use and you should recognize that those assumptions are just as critical as the interest rate assumptions you set up. I have grouped my assumptions into six different categories:

1. Interest rate scenarios.
2. Call assumptions and the various assumptions we go through in developing the actual asset cash flows for our fixed income investments.
3. Cash flow assumptions that we use for all other assets. That will probably be more critical for some of you than it is for me. I will probably appear to be glossing over it, but I want to address it briefly to the extent that we did.
4. Liability cash flows and, in particular, those portions of the liability cash flows that are subject to variations with the interest rate scenarios.
5. Reinvestment policy. In this instance, I am just as interested in finding out what you do as in explaining what I do.
6. The miscellaneous category, which includes expenses, federal income tax and the like.

Let me go through the first and primary assumption which is the interest rate scenarios. I am going to break this into two parts. The first part concerns

SCENARIOS AND ASSUMPTIONS FOR VALUATION ACTUARY WORK

what we have done for the New York submission, and the second part concerns what we have done for management purposes and what we have learned in the process of developing the interest rate scenarios for management purposes.

For New York, we basically used the scenarios that they recommended in Regulation 126 and really did not give a great deal of thought as to what their recommendations meant in terms of the underlying economic assumptions. As a consequence, we did not worry too much about whether short-term rates were inverted or not. We simply ran the long-term bond assumption, which we were using to see what would happen as we ran through the scenario. The only real analysis that we did was to try to figure out what our starting rate was. We defined the starting rate to be that interest rate as of December 31, which would be representative of what we were investing in for this particular segment.

The segment I am focusing on is our Group Pension non-participating segment. As of the end of 1986, that segment involved about \$20 billion worth of assets, about 85% of which were fixed dollar investments. Now, for New York, that was a fairly simple and straightforward investment scenario.

As we tried to figure out in 1987 what interest rate scenarios we were going to use for management purposes, we realized that, within the corporation, all the branches were behaving independently, in that each was deciding on its own interest rate scenarios for New York. In the process of trying to develop a composite interest rate scenario to be applied across the board, we realized it was not the interest rate scenarios in and of themselves that were important, but instead the economic scenarios which define the relationship.

So we went to our economist, told him our problem, and he went to work in his econometric model and worked up a series of interest rates: short-term rates, medium-term rates, long-term rates, governments, corporate bonds, Baa bonds, mortgage rates and a Standard & Poor's Index. For your own information there was only one of the six scenarios that we worked on that had a declining Standard & Poor's Index. So much for reality.

Now the purpose of what we were doing for management analysis was really to define what level of surplus the corporation needed to make certain that we would be solvent 99 out of 100 times in our future scenarios. We decided, in

PANEL DISCUSSION

the process of developing the economic scenarios, that what we really wanted was the outer reaches, the worst possible scenarios that our economist could envision. One of the comments made during this meeting as we were discussing what we were doing was that just because we had the outer reaches of what the economists view as worst possible scenarios, there is no guarantee when we ran it through our C-3 Risk tests, that what we had was really a worst-case scenario for the particular branch of business or even the corporation as a whole. We have not gone that far. What we have now are interest rate scenarios that are internally consistent with Prudential's particular investment portfolios.

For my own Group Pension branch, what I have is really a long-term investment, basically well measured by probably B or AA rated bonds, of 10 years of length. We went through and analyzed our existing December 31, 1986, portfolio and came up with a blend of investments which properly reflected what we were investing in and then used the economic interest rates that were developed by our economist to actually run through the scenarios. We have a fairly complex computer program that applies the interest rates to the specific assets that we have for our public bonds, private bonds, as well as government bonds. We applied the same program to mortgages and mortgage pass-throughs.

One of the important aspects of this computer program is the call assumption. I stress that because one of the pleas for information missing from the Prudential's investment data base is call information. That does not mean that call information does not exist; it is just hard to get access. We met with our investment people, and since the particular portfolio that I am talking about happens to be one that was designed from its inception to be asset-liability cash flow matched, there was a great deal of sensitivity on the part of the investment people to really know what might happen, not only on a C-3 Risk analysis basis, but because as a daily investment strategy the investment people needed to know how assets and liabilities were matched. As part of the process of doing this, we worked up a simple matrix which simply related the call premium on each bond to the prevailing interest rate in the scenario. If the difference between those two elements was greater than X, the bond was called. For example, if we had a 9% coupon and the prevailing rate was less than 7.4%, the bond would be called; or if we had a 13% coupon and if the prevailing rate was less than 11.05%, the bond would be called.

SCENARIOS AND ASSUMPTIONS FOR VALUATION ACTUARY WORK

The process of discussing alternatives with the investment area is part of the management analysis. One of the items discussed was that this matrix, which was sensitive to coupon values, should really be expanded to be sensitive for quality ratings as well as average life remaining for the particular bond. We thought about it, and to some extent, as soon as we can build it into our asset cash flow system, we will probably do that. Quality and number of years to maturity, fortunately, are the kinds of information that we have in our data base.

The second assumption involves developing the cash flow for the fixed assets, both for public bonds as well as private placements. We assume that all U.S. Treasury Bills are non-callable. We also assume that all our private placements are non-callable for the first 9 years. That is reflective of what our investment policy is in designing the private placements. When setting up call assumptions for your own portfolio, you would have to talk to your investment people, so that you know what you are doing as a corporation.

These fixed income investments account for 85% of our assets within our particular non-par segment. We do have common stock, real estate, a fair amount of cash and other types of equity investments. For New York, we made a simplifying assumption for the cash flow of these other assets. We said that the cash flow for these other assets will be in proportion to the fixed dollar cash flow that we have. Part of the reason that we did that is that being cash flow matched is a basic premise of this portfolio. We did use futures in order to do some of that matching. However, in going through the management analysis, we decided to go through and specifically develop the third assumption cash flows for the equity portions of the investments since we had a set of economic factors, a Standard and Poor's Index in particular. We also split out a portion of our cash and actually developed a cash flow for our futures contracts, on the assumption that all of them were exercised on December 31, 1986, and the balance of cash was brought in as a first-year cash flow.

One of the interesting results of our cash flow analysis was that the variation between the New York scenarios and the management scenarios was not as wide as might be expected. As a matter of fact, the New York scenarios had a wider range of breakeven percentages than did our management scenarios. Our management scenarios were actually within the New York scenarios.

PANEL DISCUSSION

The fourth assumptions for the liability cash flows are the next set of assumptions I would like to address. Since the portfolio I am dealing with is non-participating and since about 40% of it has to do with single sum annuities involving retired life and deferred life cash flows, we are not concerned about C-2 Risks in our analysis, although it is something that we need to address. In reality, we look at the retired life cash flows and say that a particular cash flow is not sensitive to changes in the interest rate.

Another 20% of our portfolio is made up of guaranteed interest contracts with defined cash flows which are also not subject to interest rate fluctuations. However, 40% of our portfolio is made up of investment plans and profit sharing plans wherein we have a one-year contribution window and about a 5 to 10 year withdrawal period. As a result of those two elements, the liability cash flows are indeed subject to change due to changes in the interest rate. What we have learned in the process of doing some of our pricing work is that the contributions will change about 10% for every 1% change in the interest rate. For example, if we assume that we were going to receive \$10 million in the next 12 months and that interest rates drop by 1%, then we will get 10% more or \$1 million and vice versa.

On the contribution side, we assume that for every 1% change in the interest rate, we will have a 2.5% change in the withdrawal rate. If we were assuming that a particular contract would generate a 20% withdrawal rate in the next 5 years and if interest rates went up 1%, the withdrawal rates would rise to 22.5%. We do have a minimum. Generally, the withdrawal rate would not be allowed to drop below 5%. The minimum takes into consideration expected withdrawals due to death and termination from service. For contracts which are handled on a last-in, first-out (LIFO) basis, the withdrawal rate would probably be zero in all events.

The fifth assumption is the reinvestment assumption. We use a fairly simple and straightforward reinvestment policy for our non-par segment. We assume that all of our net cash flow will be invested in 10-year investments, the same kind of investments that we are actually investing in as of year-end, which probably could be measured as a Baa 10-year investment.

SCENARIOS AND ASSUMPTIONS FOR VALUATION ACTUARY WORK

For New York, we have assumed that is true for both positive and negative cash flows. That means if you are investing a negative 10-year bond, it is just as if you were selling the same kind of investment at the same point in time.

For management purposes, since we now had short-term rates that were internally consistent with our long-term rates, we decided to test, and then ultimately use, the concept that when we borrowed, we would be borrowing at 1-year rates. Since our economic scenarios did generate inverted yield curves for 3 out of the 6 scenarios that we had, we did have, for certain periods, short-term rates that exceeded our long-term rates, so it was not always a situation where we were making the best investment strategy.

One of the things that has come out of our management analysis in our discussions with the investment people is a recognition that whatever we were building into this magical little computer program should not be recognized as reality. It is merely a rough estimate of what the investment people are really doing. One of the things I have asked myself is whether the problem that comes out of my C-3 Risk analysis is just a poor measure of what people are doing, or do they seriously have a problem with their investment policy. In order to address that issue, we intend to test the concept of duration matching for our investment policy. This would be simply a matter of going through and saying "I have an average Macaulay duration of 9 for my assets, and I have a Macaulay duration of 7 for my liabilities -- where do I put my available cash investments so that at the end of my reinvestment process I now have assets equal to my liabilities?" It really means ignoring the reinvestment policy program that you have and starting over with something new. I would be very interested to know whether any of you have systems that use a reinvestment policy similar to this, or whether your systems do something completely different. I am not asking you to disclose your investment policy, but to disclose the techniques you have used in order to come close to what your reinvestment policy really is.

The sixth category of assumptions is the "all other" category. For the default rate assumption for our New York work, we used a fairly simple assumption. We assumed that we would lose 12.5 basis points off our assets each year for the next 40 years. In the process of doing the management study, we recognize that the default rates will indeed vary with the economic scenarios, and have attempted to come up with a reasonable basis for default rates which varies not

PANEL DISCUSSION

only by year but by the economic scenario. I still believe that within that category the 12 basis points is probably a conservative assumption.

Another assumption within the "all other" category is the investment expense assumption. We use a simple offset to the gross interest rate that is generating our cash flow.

On the liability side, we have administrative expenses, which are reflective of our pricing assumptions, that are added on to the liability cash flow.

The one area that the Group Pension department needs to address is the issue of federal income taxes. What we have to do in the process of coming up with an appropriate base is to develop a tax basis surplus, define taxable income to be the difference in the change in that surplus over time, take 34% of it, and then apply a surplus tax rate to that surplus. We would probably be using something like a level 3% over the life of the contract. We have not done that, because most asset and liability computer programs simply produce the cash flows; these programs do not produce the corresponding present value of future benefits and the present value of the assets. It really is not appropriate to go in and say, I have got my liability flow and I am going to discount it at my prevailing rate, because that is not the federal income tax liability base. That is simply a market value of those particular cash flows. We have not quite figured out how to develop the present value consistently over time, for tax purposes, but we are in the process of coming up with something. If you have developed something, I would be very interested in finding out about it.

MR. ROBERT D. HOGUE: I think I am on this panel because I am Chairman of the Committee on Life Insurance Valuation Principles. So I saw my role more or less as a talker and not a doer. In that capacity, I tried to talk to all of the people who will be working in the valuation principles area to find out what they were doing. Basically, I did a survey of what these people were doing. My inherent bias on the principle side as opposed to the application side led me to attempt to define what is being done today in lieu of the valuation principles that were described by a very frustrated committee that had worked long and hard producing results and how the things being done today line up with those valuation principles. So I will try to give a view of the valuation actuary work

SCENARIOS AND ASSUMPTIONS FOR VALUATION ACTUARY WORK

both on the management report level and the regulatory compliance level and talk about where I think it might go tomorrow.

My initial impressions indicate that there are three areas in which valuation actuaries are doing things differently.

The first area is interest rate forecasting, which we all do. I put the emphasis here on the scientific forecast. Ms. Ogden mentioned that the Prudential has a macro-economist on board who tries to do this. There are other people trying to do scientific interest rate forecasting. I think that is critical. The second area involves the kinds of new methodologies and techniques that are evolving. Most valuation actuaries recognize the need for these new techniques. If the valuation actuary is going to perform an important role, the old way of doing things is not going to hold up. The third area involves the additional assumptions. Ms. Ogden mentioned a few of these. What new assumptions are working their way into the models and into the valuation actuarial work, and what is the impact of taking account of those kinds of variables. So, what follows are the results of my survey of what the learned and working people are doing.

Ms. Ogden mentioned the effort being made at Prudential vis-a-vis interest rate forecasts. I, of course, would be the last person in the world to give anything but glowing comments about the Prudential's approach. It is probably typical of most companies. A lot of companies are making three levels of effort to determine interest rates. They are the following:

Interest Rate Forecasts

- o Economists
 - Market psychology
 - Demand for bonds
- o Macro-Economists
 - Real rate of inflation
 - Demographics
- o Actuaries
 - Investment horizon
 - Interest rate grid

Most of the investment firms have economists in-house, who try to predict interest rates. If you go to these people, you have to realize that their primary interest is giving information to traders in dealing with their clients. Other people go to a couple of major firms that have macro-economists, who use large

PANEL DISCUSSION

econometric models, the kind of thing Ms. Ogden described, and those people are producing long-term interest rates. That is the only group in existence, I think, that is trying to produce long-term interest rates in any kind of a scientific basis. The problem, of course, is that since they have not been doing this for very long, time has not allowed them to demonstrate the validity of their techniques vis-à-vis quality and accuracy. Most actuaries end up determining interest rates as part of their work.

The economist normally will not give you an interest rate projection beyond about 3 months and, with caveats, a year. So you really cannot go to them for any kind of real assistance on long-term interest rates. Economists may have opinions, but they will not write them down, charge a fee for them, or even tell you then what they are.

In determining interest rate projections, economists do two things, and their primary motive is market psychology, as measured by any number of key indicators. The first thing they do is try to set down scientifically an interest rate path, and the probability of this occurrence. The second thing they do involves simply the demand for bonds. Looking at the demand for bonds, they determine a number of things. The most basic is the economy's reaction to inflation. That is the kind of thing economists use to predict interest rates.

The macro-economists use large models, obviously. They try to project as their core assumption a real rate of inflation. They base that rate upon indicators like the gross national product deflator and the money supply. They make assumptions on external events, such as monetary policies and governmental policies. These are global types of assumptions.

Macro-economists also use demographics. Demographic factors such as the work force, personal income and so on, all go into making the second set of equations. Macro-economist firms will do a macro projection, that is, their current, base projection. They will then break down those projections by industry and investment segments or whatever breakdown you would like to see. They do have some insurance clients, but not many. I do not know whether the regulators as a group or the insurance industry as a whole will go to these economists to get those kinds of projections. They have been used by the American

SCENARIOS AND ASSUMPTIONS FOR VALUATION ACTUARY WORK

Banking Association, for example, in a study which looked at future financial service outlets for commercial banks.

The last group is the actuaries. Actuaries tend to look at investment horizons in terms of the duration of our liabilities. We then set up some sort of interest rate grid that has a basis in a logic of some kind. Some of that logic is rather dubious, but that is our approach. The bottom line is that, while this method is not very rational and scientific, neither are the other methods. On a going forward basis, I think the lack of a totally rational and scientific method for accurately making interest rate forecasts is one of the key obstacles facing the valuation actuary.

As mentioned in the exposure draft of the Valuation Principles, new technologies and methodologies will be developed:

Most of the probability distributions underlying a valuation have not yet been developed because of the complexity and indeterministic nature of the environment and the events causing risk. Hence, practical deterministic alternatives are often used. p.9.

One of the surprises I had when I started speaking to various people in preparation for this panel was the extent of the use of what I call primitive stochastic processes. When the exposure draft was being put together, actuaries were farther ahead with the use of stochastic processes than we realized at the committee level. Now this is an observation: A general stochastic process seems to have arisen. I have talked to a number of practitioners and a number of people that work for individual companies. While they are using a number of different approaches, I will try to give an explanation of how these approaches work as a group.

The concepts involved in the stochastic process seem fairly simple:

1. Create a yield curve universe
2. Assign values to a transformation matrix
3. Generate random walks through the transformation matrix
4. Chart the results

The first step in the stochastic process is to create a yield curve universe. Valuation actuaries do this in a number of ways. Some just write some things down. Others go to an economist. They also look at historic rate changes and

PANEL DISCUSSION

volatility rates, and they try to calculate and make things a little more scientific.

The second step in the stochastic process is more difficult to determine. This step involves assigning values to a transformation matrix to reflect the probability that a given rate on the yield curve changes from one level to another level over a given period. These probabilistic distributions have not been well developed. Most of the methods I have heard described call this the "choose a probability p " step.

The third step involves generating random walks through the distributions and coming up with an interest rate path.

The fourth step is to chart the results and then to come up with a certain number of scenarios that are sort of mean values of all these random walks and then do the projections.

That seems to be the state of the art today. More actuaries, I think, are using this method and I have not found any other type of stochastic process being used within the insurance industry. Another process is being used in a different financial sector; however, I had difficulty in finding out how this process works because people who make money off their systems do not want to tell the details.

I will attempt to give an overview of this process. The bottom line here, however, is that there probably will be other stochastic processes that will work their way into our practice.

This process was developed for a client, and someone made money by doing it. John Cox at M.I.T. initially described this method about 5 years ago. It answers two questions that always disturbed me about stochastic processes. The first question it answers involves the "choose a probability p " step. This method attempts to calculate the probability p 's. The second involves the assigning of a weight to the probability of a given scenario. This method also attempts to calculate that number.

SCENARIOS AND ASSUMPTIONS FOR VALUATION ACTUARY WORK

The bad news, of course, is that I was not able to learn how the method works. Basically, the method starts with a current Treasury yield curve and an overnight rate which is used to adjust it. The actuary then gets an estimate of the volatility rates based upon historical data, that is, how much do these curves change over time? Then they choose a band spread. A band spread means that interest rates will never be below, for example, 5% and never above 25%. Then the actuary chooses a spread rate which is the maximum amount that interest rates will ever change by over a given period. They go through a stochastic process. They go through a projection that basically reproduces the yield curve that they started with, and that is how they calculate the probabilities. This method is a little more intricate than what I have described.

The method results in a probability distribution which actuaries say is scientifically calculated. They then make X number of runs and come up with a number of scenarios. Weights are then assigned to certain scenarios.

I think the bottom line is that we in the life insurance industry are using stochastic processes in actual application to a larger extent than I had originally thought we were. I am told that some current New York filings are using stochastic processes.

I have also learned in talking to people that many different assumptions are being used, which I think is very obvious. The most commonly used assumptions are ranked in the order in which people are saying they are most frequently used.

1. Yield curves
2. Call rates
3. Yield rate-lapse rate algorithms
4. Futures and options
5. MSVR
6. Consistency

In regard to the first assumptions, today, virtually everybody is creating yield rate universes. Most of the curves are priced to Treasuries, that is, Treasury plus X% depending on bond duration.

The second assumption, which virtually everybody has, is some kind of call rate assumption. This assumption can greatly impact the results of the projections.

PANEL DISCUSSION

As Ms. Ogden mentioned, there are no fixed rules for when bonds are called. When interest rates change, the calls occur and there is no real assumption that relates to human behavior. Mathematically, it would be logical to call a 10-year Industrial as the rates change by Y percent, but only X percent of the people do that.

The third assumption is the yield rate-lapse algorithm. This algorithm is used for interest-sensitive products to determine the change in the lapse rate resulting from a change in the credited rate. This assumption is almost universally used. I think a lot of research needs to be done on this assumption; however, there are people who have looked at empirical data and said that their algorithms are pretty good.

The fourth assumption is futures and options. Only a few actuaries are modeling the use of futures and options. There are a couple of options that are available for reinvestments, and some do this by building in options and futures kind of formulas. Three models are often used by investment houses on restructuring portfolios. There is a bond model, there is some kind of securitization model (CMO models), and then there are the option pricing models, none of which really work to an acceptable extent at this time.

Option pricing is a measure of change in strategy. It has some elements of human activity or management judgment built in. Most investment houses have these models and they all say they work. At some point in time I think those things will work their way into practice.

The Mandatory Securities Valuation Reserve (MSVR) is the fifth assumption. Changes in strategies and yield curves trigger changes in the MSVR level. Most actuaries are reflecting these changes in their modeling.

The last assumption, which was mentioned in the exposure draft, was supposed to be a very strong duty for the valuation actuary, namely, testing for internal consistency within a set of scenario assumptions. No one is doing that, but I would argue that they probably do not have to, because everyone seems to be starting with a yield curve and based upon that, they come up with some rate of inflation, and based upon that they come up with some level or assumed level of changing expense rates and changing lapse rates. By the time they are

SCENARIOS AND ASSUMPTIONS FOR VALUATION ACTUARY WORK

finished, there are not very many assumptions that are left to be consistent. If anything, over time we probably will develop better algorithms and better experience rates for doing that. But most of the modeling seems to center around the developing of the yield curves. Once these are developed, then everything else falls into place.

This all sounds very good, and my research survey was interesting, but we lack hard data. The hard data were difficult to get.

I talked to the New York Insurance Department about the Regulation 126 filings that they have received. These are the first real, required, valuation actuary type filings. Then I requested time and access so that I could look through and document the filings, in terms of what people are doing today. However, many companies' filings were confidential, which is certainly understandable. I asked members of the Department if someone could come to this meeting and give a general discussion of these filings. The Department had done a lot of research and they were very gracious. They wrote up a document which I reviewed and which I thought was a good contribution. It is probably the only real body of canvassing evidence that will tell us what valuation actuaries are doing.

Mr. Thomas Hartman of the New York Insurance Department will now give a presentation based on the Department's hard data.

MR. THOMAS KIRK HARTMAN: Peter L. Smith, Jr. also of the New York Insurance Department has prepared some comments to which I have added a few things.

Guidance in the choice of assumptions for life valuation actuarial opinions and memoranda is in an embryonic stage. The Society's Guide to Professional Conduct, Section 3, Actuarial Principles and Practices, states:

You must exercise your best efforts to ensure that any calculations performed are correct, that any recommendations made or opinions rendered are sound and are based on sufficient and reliable data, and that any assumptions used are adequate and appropriate.

The requirement that "opinions rendered are sound and are based on sufficient and reliable data" implies that base assumptions should be developed from

PANEL DISCUSSION

company experience whenever possible. There is an extensive actuarial literature in respect to GAAP assumptions and pension valuations, some of which may be helpful. In particular, chapter 5 of Anderson's text, entitled *Pension Mathematics for Actuaries*, contains an excellent discussion of statistical and quantitative tests in evaluating the significance of actuarial assumptions. The ERISA criteria required in performing pension valuations is that the actuary choose assumptions which represent his best estimate of future experience.

For Regulation 126 purposes, the level rate interest assumption should be based on new money rates available December 31, the date of valuation. For statutory valuation purposes, the assumptions should be more conservative than the most likely, or at least provide for conservative deviations from the most likely. In developing statutory estimates of future assumptions, internal companies studies, trend factors, competition and company goals may be considered. The more strongly a valuation actuary can link his base assumptions to statistically credible studies and acceptable methodologies, the less likely regulatory or professional disciplinary actions against the actuary would occur.

The standard utilized by the New York Department in evaluating the appropriateness of the qualified actuary assumptions has been sampling of representative assumptions of similar companies. We hope in future years to develop a data base capability which would enable us to develop profiles for companies with particular characteristics. Statistically credible deviations from such profiles would be cause for questioning the qualified actuary regarding the basis of his actuarial opinion and memorandum.

A valuable technique for reducing the likelihood of questioning the qualified actuary's assumptions would be the inclusion of sensitivity analysis of the assumptions in the actuarial opinion and memorandum. If the qualified actuary could demonstrate that a given assumption plus or minus one standard deviation in the underlying distribution of the variable results in sufficiency along all interest scenario paths, the actuary's opinion and memorandum would be on a much stronger basis. The actuary would no longer need to defend the particular assumption, but could argue that the range of the variable in question generally covered a reasonable set of acceptable values. Very few actuaries provided sensitivity analysis in their Regulation 126 actuarial opinion and memorandum. We hope more actuaries will take this approach in the future.

SCENARIOS AND ASSUMPTIONS FOR VALUATION ACTUARY WORK

We have sampled the actuarial opinions and memoranda and have developed some average values from these samples. The average interest rate used in the level scenario was 8.6%. Typically, this interest rate was related to intermediate or long-term asset, such as 10-year or 30-year Treasury Bills.

Very few companies considered the effects of an inverted yield curve although item 395.9(b) (3) (ii) of Regulation 126 requires such analysis. We suspect that many companies have difficulty incorporating this feature into the interest crediting policy applicable to various blocks of business. To the extent that Regulation 126 encourages companies to do cash flow analysis in the product development process and internal profitability studies, we hope to see this feature more extensively included in the actuarial opinions and memoranda.

Only several companies considered variability of mortality experience, as this is rarely a critical concern for annuity cash flow analysis. Most companies took default requirements into account, although Regulation 126 only requires this for non-investment grade (Baa or less) securities. There was a wide range of default assumptions utilized from the MSVR contribution level to lower and higher levels.

There was a wide array of assumptions with respect to call provisions. We have prepared some internal analysis of these features within the Department. Hopefully, we will be able to provide studies on the various features in the future. Some assumptions, while probably appropriate for valuation purposes, do not entirely reflect reality. One such assumption is that all group GICs terminate at the maturity date rather than rolling over.

The single premium deferred annuity lapse rates used try to reflect reality. The assumptions used here are generally quite subjective and generally take into account the difference between credited rates and earned rates.

Regulation 126 allows deficiencies produced by the cash flow analysis on one block of business to be offset by excess reserves from another block of business. Such excess reserves must be produced by cash flow analysis using the same interest rate scenario which produced the deficiencies. In addition, we may have some concern when the offsets are used and different projection periods were used for the different blocks of business. We are limiting, to some

PANEL DISCUSSION

extent, the excess that may be used by requiring that the value of the liabilities used to calculate the excess be the higher of the statutory liabilities and the liabilities produced according to cash flow analysis.

Of the actuarial opinions and memoranda reviewed to date, seven have not been accepted. Of the seven rejected, three were for fairly serious actuarial flaws, the other four primarily failed to take account of certain methodological and technical requirements of Regulation 126, particularly the requirement that assets be less than or equal to liabilities at the initiation of the study.

MR. KENNETH T. CLARK: I'm here in a cameo role to add a footnote to this discussion of what I think is the most exciting development in our profession today.

In Canada, the valuation actuary concept has been with us for almost 10 years. It is working much better than the old system would have worked, but it is not yet working well enough. I suspect that you are mainly an American audience and I hope that the Canadian experience will be of interest on how-to-do-it and how-not-to-do-it.

Canadian valuation practices used to be similar to U.S. statutory valuation practices, 1958 CSO 3.5% Commissioners Reserve Valuation Method. In 1977, the laws were changed to prescribe a valuation method, which is a conservative version of the GAAP valuation method in the U.S., but to leave the choice of scenarios and assumptions to the valuation actuary. That giddy exercise of valuation actuarial power is subject to regulatory review, but in practice the regulator has rarely forced a valuation actuary to change his assumptions. This does not mean, unfortunately, that the regulator has always been happy with the assumptions. He has not been, but the power to force a change in assumptions is far from a panacea.

There are two reasons for this. One is that the regulator wants the assumptions to be a product of a valuation actuary's judgment, so he is loath to challenge that judgment without strong cause. The other reason is that the valuation actuary's report, which is the regulator's prima facie source of information, is a document of 50 to 100 pages, bristling with technicality and drafted with the dazzling simplicity and clarity for which we actuaries are so justly admired. The

SCENARIOS AND ASSUMPTIONS FOR VALUATION ACTUARY WORK

regulator does not have an army of patient actuarial reviewers, and even if he did, there is no assurance that they could winnow the less-than-professional chaff from the professional wheat.

The bad news therefore is that the regulator is frustrated. The good news is that he vented his frustration on the actuarial profession. Stripped of the polite bureaucratic veneer, the regulator's message to the profession is:

First, the regulator believes in the valuation actuary concept.

However, second, the range of results arrived at by different actuaries faced with the same problem is too great. Part of the range must be wrong.

Third, some of the assumptions are scary. But who is to say who is right? It seems that a valuation actuary's assumption may be subject to dispute, but not correction.

Fourth, will you guys therefore kindly clean up your act?

From the beginning, the profession had standards of practice to guide valuation actuaries in their work. The Recommendations for Insurance Company Financial Reporting were formally adopted in 1979. At first, they were radical, revolutionary, even seditious; their development was controversial. Over the years, Recommendations have become respectable motherhood statements. It seems that they are not specific enough, and we are putting in place more detailed, and sometimes painfully specific, standards of practice. The new standards are called "valuation technique papers."

We have one technique paper on the valuation of the so-called Term to 100 policy, which is a whole life policy, sold initially with no non-forfeiture benefits, but today sold with a bewildering variety of non-forfeiture benefits, which range from meager to lavish and back again over the term of the policy. The withdrawal rate assumption for this product is critical; the valuation technique paper's guidance is specific, some say too specific, that is, too conservative.

We have another technique paper on the valuation of renewable term insurance, where the assumption about the interaction between withdrawals and mortality

PANEL DISCUSSION

anti-selection is so critical. In the works, we have a technique paper on accounting for reinsurance, specifically surplus relief coinsurance, and a technique paper on the choice of a new money interest rate assumption 10 and 20 years hence.

The original Recommendations deal in general terms with the provision for adverse deviations, saying, in effect: Be conservative, but don't be too conservative. That noble precept has not worked well enough. In order to write standards which quantify the appropriate provision for adverse deviations, we have embarked on a major research effort. This has led to a blockbuster paper, which is now before the profession and which is, according to your taste, either an inspired breakthrough or a vicious straitjacket.

Up to now my presentation to you has been as objective as I can muster and I dare say as dull as you can stand. Perhaps my personal subjective opinion will be more interesting. What lesson can we learn from the Canadian experience?

In 1977, the valuation actuary was given his freedom. That freedom was constrained by regulatory review, which has proven to be not much of a constraint. That freedom was also constrained by the initial professional standards of practice, which also have proven to be not much of a constraint. The initial standards are being supplemented by more detailed standards which, some say, are so specific that they would be best written as regulations by the regulator.

I strongly support those detailed standards, even though some features of them are repugnant. But the world is imperfect. The world is political. The world overreacts to financial crises. The world wants a solution, if need be a partial solution, right now, before an ideal solution can be found. He who insists on the ideal solution at the outset will not be invited to play in the game a second time.

The crux of the matter is that the actuarial profession should have control over actuarial work. If we lose that control, it will be hard to get it back. To keep that control, we should be quite willing to make temporary compromises, to adopt interim solutions. With control, we can then take the time which we need to find the ideal solution. And our interim solution and our ideal solution will be much better than anybody else's interim solution or ideal solution.

SCENARIOS AND ASSUMPTIONS FOR VALUATION ACTUARY WORK

We have adopted overly specific standards of practice and we are going to have to adopt more of them. They are ingenious stopgaps. They deal well enough with a claimant problem for which a quick fix is politically necessary, and give us time to find a better solution. What will the better solution be? I suspect peer review, better continuing education, but of course standards of practice will always be important. Peer review is especially difficult. I believe that peer review of the valuation actuary's work is necessary, but it is so difficult, it will take time to work out.

The professional risk of adopting interim solutions is that we do not follow through, that we allow the compromise to stand, to become comfortable, conventional, entrenched wisdom. But I have enough confidence in our profession to take that risk.

The lesson of the Canadian experience is that the world is better off with the valuation actuary concept even when the actuarial profession is inadequately prepared for it when it comes. It seems that we actuaries can cope.

MR. MENKES: I shudder to think what might happen over the next 5 or 10 years if we do not stay involved given that we will be dealing with probably 50 state insurance departments who are trying to get a grasp on this. I think if we stay involved and address the issues, even if we are learning as we propose standards of practice, we will be much better off for it than to have the regulators turn elsewhere. We will now open up the session for discussion.

MR. PETER S. KREUTER: I am with the New York Insurance Department and I have a question for Sue Ogden. In the selection of assumptions, could you comment on the importance on empirical data. For example, where you said that in the window GIC you assume that a 1% decline in interest rates results in a 10% increase in deposits, is that based on recent data? Does that change as new data emerges?

MS. OGDEN: It was based on original data that we had when we first started selling those particular products. We have not analyzed the experience since then for the contributions but we have looked at the empirical data supporting the withdrawals. We have learned that our assumption that when interest rates would drop withdrawal rates would also drop has not actually happened. Over

PANEL DISCUSSION

the last several years, as interest rates have declined, withdrawals have actually increased. We have not really decided whether that is just a fluke in the economy, due to the fact that a lot of companies were just trying to recover from certain adverse business cycles, or whether it really represents an error in what we originally assumed. Since changing it would have made our results more positive, we did not really feel it was necessary to make the change until we had a pretty firm understanding of what was causing the problem.

MR. MENKES: One of the things I found interesting about the comments that Mr. Hartman made relating to this question, is, at least for now, the New York Department is using as a standard what might be considered reasonable representative assumptions that it takes from its filings. That is not necessarily a bad way to go about it, but we heard Ms. Ogden talk about the process which Prudential went through, where they first did their statutory filing based on the required scenarios, and excluding some refinements which were ultimately made during their management report. If everybody would do this, you could paint a picture in which Department would be basing its standards on what people were doing just to comply, and not on information that companies were developing when they really had more time to go about preparing these management studies. We hope that over time the valuation actuary work might be a by-product of the internal management studies, so that more of this information might become available to the regulators.

MS. OGDEN: May I ask a question of the audience? One of the questions that I asked while I was talking was, what do you do in your reinvestment policy? Is there anyone that is willing to share how you handle the reinvestment of your net cash flow?

MR. DENNIS A. DEETER: I work for Milliman & Robertson. I will share with you two things that we have seen and some of the things that we have done. One is that, for one client, after we did all the scenario testing and we saw that some of the results were pretty bad, we looked at the yield curves that produced the poorest results with the client. The client, upon seeing the results, said "Wait a minute, if interest rates are there, I'm not going to do this. I'm not going to do what we said originally, I'm going to do something else." So we literally sat down with the client and asked him, "Okay, interest rates are here now, what are you going to do?" And a year later, interest rates are now here,

SCENARIOS AND ASSUMPTIONS FOR VALUATION ACTUARY WORK

"What are you going to do, and so forth for all future years?" That was one approach. A very pragmatic approach.

Another approach we tried was to have the investment person define a sort of pain threshold, where he looked at the yield curve that was in effect for a given year and then looked at the extra margin he needs to go out 10 years or 20 years. If the extra yield was not there based on the extra risk that was involved, they were not going to do it. Again, another very practical approach. In both cases it was a really trying kind of experience because we really had to sit down with the clients and talk with them heart to heart.

MR. SELIG EHRLICH: I work for Equitable Life and I have got a question for Ms. Ogden. Do you have any data that has allowed you to true up or check the accuracy of your call assumption? Financially, it makes sense to tie your assumed calls to the difference between the coupon rate versus the environment, but I have seen a lot of noise in some of our data where issues that financially have no business being called, are coming back for other reasons. I was wondering how substantial the noise is in what you have seen.

MS. OGDEN: We did have our investment people review the assumptions, but as far as I can tell, we have never really specifically gone back and made tests. I think perhaps the experience over the last years since interest rates have fallen might have been a good time to make that test. However, we have not made any empirical analysis on it.

MR. MENKES: One thing I have found interesting, which Ms. Ogden hit on a little bit, was the fact that your economist's guess as to what the 6 worst economic scenarios would be were not necessarily the scenarios which would have provided the six worst financial results for the given products. I am wondering whether, being as they were deterministically made, this says that, maybe we should be looking at stochastically generated scenarios. When you use a stochastic process to determine interest rate scenarios, you are still making a bet that you think you know what is going to happen to interest rates. But by using a sort of random walk or Monte Carlo method and by making enough trials, you are making sure that you encompass enough different outcomes so that maybe some things you may have overlooked in deciding which are the most serious scenarios for your purposes get into the picture. So that in Prudential's

PANEL DISCUSSION

specific case, we are talking about a situation where for management to be comfortable, it wants to remain solvent 99 times out of 100. One approach might be that once you have taken your position on what interest rates might do, then run 100 different random walks, 100 different trials, and if you come up insolvent more than one time, you can either write it off as experimental error or review what you have done. That is a way to encompass a broader range of possible outcomes than what you are doing, in such a way that people do not accuse the economist of being subjective.

MS. OGDEN: I think it would be difficult to come up with a scenario which happens to be a worst case scenario for every single branch at the same point in time. What may be a worst case scenario for the Group Pension operations may not be a worst case scenario for the Individual branch of business, and vice versa. We really do assume that there will be some balancing of asset-liability matching across all branches. In the process of what we were doing for the management study, we tried to get the various actuaries involved in the process. This is going to be, for example, the first year and the first effort on the part of the Individual branch of business on the life insurance side of the house to do C-3 Risk tests. It is, although we have to learn how to walk before we run, and we have to get them thinking about it before we try to do it stochastically. Moreover, stochastic testing is extremely expensive.

MR. MENKES: That is right. For valuation actuarial work, I think we are going to have to weigh the benefits of projecting assets and liabilities through hundreds of random walks with our deadlines and our budgets. It is not an easy call. Are there any other comments? Are any of you caught in situations in your company where there is some debate over who should be choosing these scenarios?

MR. HOGUE: This was something that our committee has discussed extensively. My personal feeling is that future yield curves cannot really be determined. Even with what the macro-economists do with their modeling, it does not really give you probabilities assigned to future yield curve scenarios and other similar items. Since these scenarios cannot be determined, they have to be chosen.

The New York Insurance Department was the first to choose interest rate scenarios which actually had to be used. The valuation actuary, currently

SCENARIOS AND ASSUMPTIONS FOR VALUATION ACTUARY WORK

following the most modern techniques, will choose a yield rate universe, a probability of change from one point to another point along that universe and a probability that a certain scenario will occur. That is the basis of his work. Yet there is no scientific way to determine those probabilities at this point, although some preliminary efforts have been made.

There are two levels to be considered. The regulators want reports for certain reasons and I think they would have to choose those scenarios. So I agree with New York on that basis. The second is that management wants reports for certain reasons, as is true in the Prudential case, and management should choose the scenarios that they want to see. I think that is the way it should be and that is the way it is.

