

# RECORD OF SOCIETY OF ACTUARIES 1991 VOL. 17 NO. 4A

## CASH-FLOW TESTING

Moderator: THOMAS W. REESE  
Panelists: WILLIAM R. BRITTON, JR.  
J. HELMUT ENGELS  
PAUL A. HEKMAN  
Recorder: THOMAS W. REESE

As we approach the 1991 annual statement obligations and requirements of Actuarial Standards of Practice (ASP) 14, this session will discuss the following issues:

- Difficulties in the cash-flow testing process
  - Asset construction and assumptions
  - Liability construction and assumptions
  - Strategies
- Interpretation of results
- How do you cost-justify cash-flow testing?
- Canadian cash-flow techniques and issues
- Asset liquidation versus borrowing

MR. THOMAS W. REESE: Our panel consists of three speakers. Bill Britton is a vice president in Tillinghast's Hartford office. His main practice area is strategy, marketing, and product development for companies selling life and annuity products. He is going to give an overview of the reasons to perform cash-flow testing and some remarks about how to interpret the results.

Our second speaker will be Helmut Engels, who is actuarial vice president in the Corporate Financial Division of Manufacturers Life here in Toronto. He is a member of the CIA Committee on Solvency Standards that has recently proposed standards that include cash-flow testing. Helmut is going to give us an overview of cash-flow testing topics from the Canadian point of view.

Paul Hekman, our third speaker, is senior manager, actuarial services at PolySystems. Paul will give an overview of the selection of assets from an unsegmented investment portfolio. Paul is experienced in speaking about cash-flow testing problems. PolySystems recently sponsored a two-day seminar on this topic, and Paul also participated in the Society of Actuaries Seminar on Financial Reporting held in New York in May and the San Francisco Asset Liability Modeling Seminar that was held in San Francisco last year.

MR. WILLIAM R. BRITTON, JR.: Right now the valuation actuary is in a quandary. In the U.S., we are accustomed to verifying that reserves have been calculated according to prescribed standards. We are not really accustomed to striking out on our own by saying what reserves are adequate. And we are getting less guidance than we would like to have, particularly in the area of interpretation of results. The actuarial standards are evolving and will continue to be written. For a lot of us, this is future shock.

We also are in a different role with management. We are typically part of management, but we are making opinions in an area that can be both critical of management and very disturbing to management.

## PANEL DISCUSSION

And we are in a situation where the rules or guidelines let us know what is necessary, but not what is sufficient to make the opinion. Furthermore, after having done what we think is necessary and sufficient, it may not even be adequate to cover all the risks that are involved. I doubt that cash-flow testing, in and of itself, would have prevented any of the recent insolvencies that we've seen.

So we are in a strange new world now. I would like to cover some cradle and grave issues:

- Why do we need cash-flow testing to begin with?
- And once we've done it, how do we interpret the results that come out?

As a very simple response to the first question, we need cash-flow testing, because the standard valuation law will require it for most companies beginning in 1992, and ASP 14 requires it, effective October 15, in many areas of our practice.

But that is not the only reason to perform cash-flow testing. Before getting to other reasons, let's answer the question, why shouldn't we perform cash-flow testing? Here are some of the reasons given:

- First of all, it is too expensive. You may need to acquire asset/liability modeling (ALM) software if you have not already developed it. If you have not built your software already, I would not suggest that you try at this juncture, since there are several good commercial software packages available. To try and do it by yourself at this point in time would be an expensive, difficult task, and I think it would be better to acquire packages that will keep up with the complex changes in assets and actuarial methodology.
- Second, it is too laborious. Even though you can afford it, you may not want to devote your actuaries' time to cash-flow testing because they're too busy doing other projects.
- It is also too iffy. What if interest rates move up? What if interest rates move down? What if our excess lapse function is different from our assumption? What does it mean when we get a wide range of results? And in a very real sense, the whole exercise is too iffy because there is only going to be one future path of interest rates. The problem is, we just do not know what it is.
- And finally, you might say cash-flow testing is not needed for my company, my lines of business, or my products, because the results are not sensitive to interest rate changes. And in some cases you may be right.

But for most of us, those answers are not very good answers and we should not use them to avoid cash-flow testing. Let me share with you some of the lessons I have learned from cash-flow testing:

- First, a level interest assumption is a dangerous thing. Frequently we find that the "expected" result, that is, the result arising from assuming a continuation of today's level interest rates, is the best result out of all the tested scenarios. And if the level interest rate result is not the best, it is often somewhere close

## CASH-FLOW TESTING

to the top. Thus, relying on a level interest assumption can delude you into a sense of comfort with a strategy that is likely to lead to poor results.

- Second, a counterintuitive result may not be. The corollary is that if you dig hard enough, future intuition will improve. This is where the real value of cash-flow testing comes in. The "unexpected" results need to be evaluated to see what is going on in your product, or your investment strategy, or your crediting strategy, and thus to learn more about how your business will be affected by changes in interest rates.
- Finally, the process itself will be beneficial to management. You will learn a lot. In fact, you will learn a lot more from writing the report than from reading the report. That is a line I borrowed from a comment made on strategic planning, but it applies equally well to cash-flow testing.

Why else should you do cash-flow testing? Unquestionably, the profitability of both your new and in-force business will improve. Companies are finding that there is a lot of profit potential in their in-force business. With proper management of in-force assets and liabilities, future profitability can be improved significantly.

Second, you reduce the likelihood of surprises, since you will better understand the conditions that will lead to trouble for your product lines.

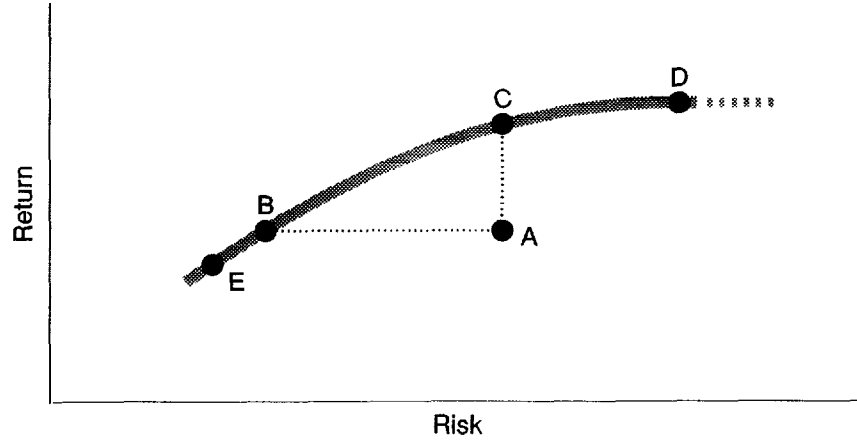
Third, you will get a better understanding of management's appetite for risk. Chart 1 illustrates an adaptation of Markowitz' Efficient Frontier Concept that was originally developed for evaluating investment risk and return. It can also be used in cash-flow testing to evaluate combinations of product specifications, interest crediting strategies, and investment strategies.

The horizontal axis measures risk. Risk can be a statistical measure, such as the standard deviation of a series of trials, or it can be the likelihood of occurrence of an event, or a combination of events that management wants to avoid. For example, risk could be measured by the number of trials in which there was negative surplus at the end of the observation period. Alternatively, it could be a combination of the number of trials that have negative earnings at any point during the observation period and fail to meet a threshold rate of return over the period. Return, on the vertical axis, could be represented by ROE, profit margin, or present value of book profits, for example.

In the illustration, strategy A is clearly inferior, since the same return could be achieved for less risk with strategy B, and greater return could be realized at the same risk with strategy C. Strategies B, C, D, and E lie on an Efficient Frontier curve representing trade-offs between risk and return. Management can then choose the strategy that best fits its risk/reward profile.

And finally, the decade of the 1980s has shown us that product differentiation does not have much lasting value, and that high-yield investment strategies have a lot of downside risk. Companies seeking a competitive edge will have a hard time finding it either in products or in investments. Competitive superiority may well come from the ability to manage the asset/liability relationship through cash-flow testing.

# *The Efficient Frontier*



1790

PANEL DISCUSSION  
CHART 1

## CASH-FLOW TESTING

Cash-flow testing will become the heart of our management process. We will design a product and use cash-flow testing to evaluate the product design itself and to set investment strategies and crediting strategies that make sense with each other. As illustrated in Chart 2, we will put it all together through cash-flow testing to ensure that the process is working.

Let us take a look now at the changing valuation actuary environment. ASP-7 tells us how to test and ASP-14 tells us when to test, but we do not have a standard yet on how to evaluate the results. For reserve adequacy, we know we should look at the market value of surplus at the end of the period; that is, market value of assets (using a continuation of then current interest rates) compared to the cash values. For testing solvency, we know we need to look at each book surplus throughout the observation period.

But once we have done this, how do we know when we have done enough, and how can we be sure assets will be adequate? There are no simple answers, but it may be worthwhile discussing a number of interpretation issues.

First of all, what kind of scenarios should we use? Deterministic or stochastic? Deterministic scenarios have the advantage of being simple and understandable. They are extremely effective for diagnosing what is happening in your product design, your crediting strategy, and your investment strategy. They can help you identify interest rate paths that will be problematic for your product. They are also easy to communicate, since people can see one interest rate path, understand what it does, and know what the results are. On the other hand, you can get into very long arguments about the plausibility of a particular scenario. Furthermore, you do not have a good idea of the range of possible results, or the likelihood of results being better or worse than expected.

For stochastic scenarios, the advantages are that you get the range and distribution of possible results; and if you do enough, you can get statistical significance. On the other hand, there is a lot more work, and it is almost impossible to follow an individual path and see what's going on. It is harder to communicate results, because there are literally millions of numbers in a typical test that need to be condensed into a smaller form that management can understand and use. In summary, I believe that both stochastic and deterministic scenarios are needed and we may evolve to a situation where we'll have a common set of prescribed scenarios, both deterministic and stochastic, to use for valuation actuary testing.

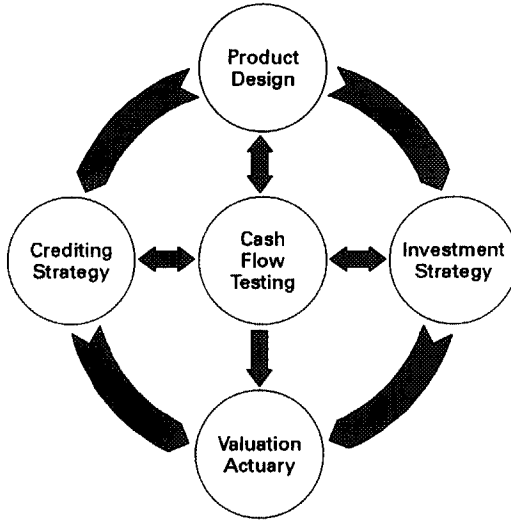
How many scenarios are enough? New York Regulation 126 requires the New York 7 (or the New York 8, with one inverted yield curve) scenarios. ASP-7 is not specific. Tillinghast typically uses 200 stochastic scenarios to get a reliable 10th percentile and 90th percentile result. That is, with 200 scenarios, you can look at the middle 80% of results with some sense of confidence in the endpoints.

How many bad scenarios are acceptable? On one hand, if all of the results are bad, that is clearly not acceptable. On the other hand, a standard based on no bad scenarios would be too severe. In addition to the number of scenarios that are bad, you also need to know how negative the results are. Also, you may find that a particular scenario had a sharp increase in interest rates right at a time that your

PANEL DISCUSSION

CHART 2

*The ALM Control Cycle*



## CASH-FLOW TESTING

surrender charges expired, so you can get anomalous situations. You also need to evaluate bad scenarios in light of the underlying conservatism of your assumptions. Most of the actuaries I've talked with look for a 90-95% confidence interval, but there is no unanimity of opinion on the appropriate level.

Another area that can lead to problems in interpreting results includes a variety of factors that I will label as model breakdowns. When you get involved in scenario testing, you are going to find that no matter how good the model is, it is going to have some limitations. Typically, you will find breakdowns at the extremes of interest rates or when a number of unlikely events occur simultaneously. What you then must do is analyze the situation to see if management would really act the way the model indicates. Are these actions we would take with products or our investment strategy? And are these the actions that our competitors would take? Usually you will find that many of your formulas, or functions, will be adequate over most ranges, but will break down in some cases. As a result, we would typically toss out some of the best and some of the worst scenarios. As I mentioned earlier, we focus on something like the 80% middle interval. The worst results should be reviewed to see what caused them, but in terms of using the results, focus on a smaller subset.

Furthermore, no matter how good the model is now, people are going to continue to invent assets that we can't model adequately. In fact, many existing assets can't be modeled well.

How good are our assumptions? One of the things we are going to have to develop is some experience justification for functions like excess lapse. We are all using formulas that seem reasonable, but we do not really have any experience justification for them. Ironically, one problem has been that interest rates have not moved enough recently to provide us with experience to validate the lapse functions.

Another issue is the treatment of policyholder and shareholder dividends that the regulations require you to consider. A major problem is that you can frequently pay out money early in the projection that will be needed later, so you would like to find a way of withholding or smoothing dividend payout. One technique is to start with no target surplus and instead develop it as you move along within the projection, and pay shareholder dividends out of the target surplus, or out of the excess surplus over the target surplus that has developed. Some models may have difficulty with allowing dividends to be calculated dynamically, or for dividend changes to be considered over multiple calendar years. Another problem that I have run across is that of the funding of the payout. The manner in which you pay it, that is whether you sell or borrow, can affect the results.

Should Mandatory Securities Valuation Reserve (MSVR) and target surplus be counted as initial assets? Target surplus can be used for solvency testing, but not for reserve adequacy. If there are negative results without MSVR, it would be worthwhile going back and looking at whether the addition of MSVR to your starting assets would give you adequacy in the long run.

How about new business? For reserve adequacy, you probably should not include it, but you should include it if you are using the cash-flow testing to look at your future projections for the ongoing management of your business. One of the problems I

## PANEL DISCUSSION

always have with new business is, what happens if it ever stops? You have to be very careful that your results are not predicated on a continuation of new business.

And finally, how about aggregation of lines of business? Aggregation should be permitted because many companies are actively pursuing a strategy of selling a managed combination accumulation and payout annuities, for example. Others are doing internal stripping of assets for use by different product lines.

My comments by no means answer the questions facing the valuation actuary, but I hope they will be helpful in providing guidance.

MR. J. HELMUT ENGELS: I will cover some topics in the field of cash-flow testing that are specific to Canada.

Let me say up front that cash-flow testing is generically no different in Canada than in the U.S. All the techniques, the methodology, and even the software, are inherently the same. What is different is the statutory reserving methods or other professional requirements that cause some of the cash-flow testing to be done, or that determine the form that the cash-flow testing takes. I hope I am not going to repeat anything the other two panelists are covering, but I will talk about some Canadian requirements where cash-flow testing is needed, and what form this takes.

There are three topics I want to cover. The first is how asset cash-flows have to be taken into account in setting reserves for Canadian companies. The next topic is a fairly recent one that is still under discussion. It involves a new proposed way of valuing single-premium annuities. The third topic is a new standard that has recently been introduced in Canada called Dynamic Solvency Testing (DST).

The Canadian Institute of Actuaries has a set of professional standards that valuation actuaries have to follow when valuing the reserves for Canadian statutory purposes. The standards are called the "Recommendations for Life Insurance Company Financial Reporting." These recommendations outline what the actuary has to consider in setting reserve assumptions.

One of the prime requirements in these valuation standards is that the assumptions to be employed should be appropriate to the circumstances of the company and the policies in force. Assumptions are not prescribed by law or regulation in Canada. The assumptions depend heavily on the actuary's judgment. When setting the reserve assumptions, the actuary has to include a provision for adverse deviations, which is conveniently called the PAD. In choosing the PAD, there is a requirement that the more uncertainty about the risk, or the farther in the future you project, the larger the PAD that is needed.

With that as background, I want to talk about how cash flows get into the reserve-setting process.

Specifically, with respect to assets, the actuary has to consider the projected returns on the current assets, which means that you have to know what the underlying rates of interest are, both now and in the future. You have to decide what reinvestment rates to use for future positive and negative cash flows. You have to consider



## CASH-FLOW TESTING

company policy with respect to dividend scale changes, and interest crediting strategies.

The actuary has to understand the characteristics of the assets, such as call provisions. In setting the margins in the liabilities, the actuary has to consider the quality of the assets, since the reserves should include margins for defaults.

In doing all of this, the actuary has to talk with the investment people about the company's current and projected investment policy. For instance, if it is the company's policy to maintain a close match between assets and liabilities, then the actuary does not have to include as large a PAD in reserves, compared with not being in a well-matched position.

So, in summary, when setting reserves the actuary has to not only value the liabilities, but also consider the assets and their expected cash flows.

Every year the valuation actuary of a company is required to produce a report called the Actuary's Report. This report goes to the Canadian regulators in Ottawa. Before year-end, the regulators issue instructions with respect to what the report has to contain and what it must discuss.

Specifically, with respect to assets and cash-flow testing, the actuary must disclose what procedures he used to test whether the assets and liabilities are matched. He has to disclose what assumptions he used for future cash flows for both assets and liabilities. He has to disclose how closely the assets and liabilities are matched by duration and by yield. He also has to disclose the results of any sensitivity studies done. To give you an idea of the size of this report, for my company it was 117 pages last year. The report is confidential and not public.

In summary, in Canadian statutory reporting the actuary certifies that the reserves are appropriate for the company. The reserves should not be too conservative, but they also should not be deficient. Thus, for valuation purposes, especially for interest-sensitive products, the actuary must do cash-flow testing and know the inter-relationships between assets and liabilities and the characteristics of both, in order to produce appropriate reserves.

The next topic I want to talk about is a paper that is currently being discussed in the Canadian Institute of Actuaries dealing with the valuation of single-premium annuities. I mentioned earlier that there were standards in Canada called the Recommendations. In addition to the Recommendations, there is series of what are called technique papers that have been developed and accepted by the Canadian Institute. These cover specific valuation topics in more detail than the recommendations. Once a technique paper has gone through due process, it becomes mandatory that valuation actuaries comply with it.

There is one paper that is currently working its way through the process. It is in the discussion draft stage and so it hasn't been accepted yet. It is called Valuation Technique Paper No. 9. This involves the valuation of single-premium annuities, both individual and group, and both deferred and vested.

## PANEL DISCUSSION

This technique paper would require the actuary to project cash flows for both assets and liabilities. For each specific block of business he has to start by identifying the liabilities and the block of assets that is backing that block of business.

The cash flows of the assets must support the cash flows of the liabilities. The actuary would have to test what happens to the cash flows under a variety of interest scenarios. These should be reasonable economic scenarios. It is left to the actuary's judgment how many scenarios should be tested. The number of scenarios should depend on how sensitive the block is to changes.

The assets must be adequate to support almost all reasonable scenarios. If the assets are not adequate, you have to add additional assets to the block and do the cash-flow testing again. When you have finally done all that testing and you have proved that the assets that you now have are sufficient, then the reserves for the block are set equal to the statement value of the assets.

As I said earlier, this paper is now at the discussion draft stage and still has to go through an exposure draft and then the final acceptance, if it goes all the way. Some companies are already doing their valuation using this type of technique. In essence you are valuing the entire portfolio of business, assets and liabilities together, using cash-flow testing under multiple scenarios. And the result is used to actually set the level of your liabilities in the statutory statement.

The next topic is DST. It is not a method of determining reserves, but a way of testing the future adequacy of a company's surplus and capital.

First, let me give you some background. In Canada we are moving to a new reserve method called the policy premium method. The general expectation is that this will release some reserves. This caused some concern that the solvency position of companies was being weakened as a result.

The purpose of DST is to be a tool to help ensure the continued solvency of companies. It is a new CIA standard. After several years of development by a CIA committee, it was officially accepted this past June. It was set to be effective starting in 1992.

It is interesting that the standard was developed by the Canadian Institute of Actuaries as a professional standard. There was no official regulatory requirement for this at the time the work was started, although the regulators certainly did not object. There is an interesting statistic that no policyholder has ever lost any benefits due to bankruptcy of a Canadian life insurance company. The Institute of Actuaries wanted to develop a tool that would help to ensure that this will continue to be the case. This work also fits in with the new evolving role of the valuation actuary in Canada, in that he is not to just give an opinion on the reserves at the past year-end. He also has to be concerned with the future financial condition of the company.

There is new Canadian life insurance legislation working its way through Parliament, with a plan for it to be effective at the start of 1992. This insurance legislation includes the requirement to do future projections of the company's financial condition using accepted actuarial standards, and in this case accepted actuarial standards is

## CASH-FLOW TESTING

the DST. So it will not be just a professional requirement; it will also be a regulatory requirement.

Let me quickly describe what DST requires the actuary to do. The actuary has to do a five-year projection of a company's financial statements.

At the moment there is a formula for determining minimum capital and surplus requirements introduced by the Canadian Life and Health Insurance Association in connection with the guarantee fund that was established a couple of years ago.

It is a risk-based capital approach, whereby the riskier assets and product lines need more surplus. The new life insurance law that is going through Parliament also gives the regulator the right to establish minimum capital requirements, and it is anticipated that they will do so as soon as the new law is passed.

The key question that has to be addressed by these projections is whether the company will continue to meet these minimum capital requirements. Are there any potential dangers to solvency?

In doing this five-year projection, both in-force and new business has to be included. The actuary would normally use the company's five-year plan, if it exists. If there isn't one, then it is up to the actuary to come up with what he thinks the company will do.

The modeling work that is required is deterministic and not stochastic. In this, it is somewhat akin to what is required under Regulation 126 in New York.

The first thing that is required is a base scenario. The assumptions that go into this are to be the actuary's best guess for the next five years.

Then the actuary has to do projections using other suggested scenarios. The actual standard lists 10 suggested scenarios. Originally they were called required scenarios, but this was changed to make them suggested, thus leaving more room for the actuary's judgment.

After that, the actuary should do additional scenarios, if needed. The purpose of DST is to do sensitivity testing. If some of the original set of suggested scenarios show some materially adverse changes in surplus, then the actuary should do additional testing of those situations.

The result of doing DST is not to come up with a single number. The actuary cannot say, "If you have this much surplus, you are safe." The purpose of DST is to identify possible risks to solvency, and to give more understanding about how sensitive the company is to these risks. It is not a forecast.

The actuary has to personally report the results of this work to the board annually. This is a requirement of both the CIA standard and the new legislation.

The report to the board is a private report. It is not required to be made public. We want the actuary to be as open as possible in this report. The Canadian minimum

## PANEL DISCUSSION

capital requirements are also not public. We do assume that the Ottawa regulators will want to see the report when they are in for their regular examinations of the company.

The main audience is management and the board. One of the prime assumptions behind this is that management is not stupid. If there are any potential risks to solvency, they would want to know.

The prime aim of it, as I said before, is sensitivity testing. It is to give some idea of whether the company will be sensitive to certain adverse scenarios and how sensitive.

It is required to be done for the worldwide business of Canadian companies. It is also required to be done by U.S. and other foreign companies operating in Canada, but just for their Canadian block of business.

Listed below are the 10 suggested scenarios. None of them are horrendously adverse.

- |                        |                               |
|------------------------|-------------------------------|
| 1. Mortality           | 6. Level new sales            |
| 2. Morbidity           | 7. High new sales             |
| 3. Withdrawals         | 8. Sudden worsening mortality |
| 4. Increasing interest | 9. Double defaults            |
| 5. Decreasing interest | 10. Expenses                  |

The first scenario is testing what happens if mortality deteriorates by 3% a year for the five years and then stays at that level. The second is the same, except it is for morbidity.

For withdrawals you should test what will happen if they double or if they decrease to half, whichever is more adverse.

There are two scenarios for interest. One is for decreasing interest rates and one is for increasing interest. And again, it is a 3% increase or decrease over a five-year period.

Then you have scenarios for what happens if your sales are level or if you have very high sales for a few years.

Scenario 8 is a sudden worsening in mortality experience. Mortality is assumed to be at the 95th percentile. Or in other words, in the first year of the projection, the company has the worst mortality experience in 20 years, and then goes back to normal mortality.

Number 9 is a scenario where you double your asset default assumptions for the five years.

Number 10 involves expenses growing faster than the inflation rate that you have built into your valuation.

## CASH-FLOW TESTING

DST in essence requires the actuary to do cash-flow testing for the whole company. Most companies are going to be using a model to do these projections.

They will need to model their liabilities and their assets, and the resulting cash flows. The actuary has to model how they will behave under the different scenarios. He has to know the cash-flow characteristics of all the assets and liabilities. The projections also have to model minimum capital requirements.

There are some other interesting issues around DST that I would like to mention quickly. I have said that it is a five-year projection. But really it is more than that. At the end of the five years, the actuary is required to change reserves for each scenario to reflect the new experience at that time.

So if your mortality has gone up by 15% over the five years, at that point you have to change your mortality table to reflect that increase in mortality – revalue your reserves using that new table. So you not only have the effect of the worse experience for the five years of the projection, but you also have to assume it will continue at that level for the remaining duration of the policies. In a lot of cases, the changing of the reserve assumptions at the end of the five years has more of an effect on surplus than the poor experience in the five years of the projection.

If the company has small or immaterial lines of business, the actuary is allowed to use his judgment as to the amount of detailed work that is needed. We didn't want actuaries being forced to do needless work for small blocks where there is no material risk.

The actuary has to consider the investment policy of the company and whether it would change if external conditions changed.

The actuary has to consider the company's dividend policy. Usually with dividends there is a lag between when the company experiences changes and when it actually reflects that in the dividend scale. The modeling work has to include this type of lag in management reaction time.

The actuary, in his modeling, has to consider the company's policy with respect to repricing those products where it is possible and how quickly this repricing would be done to take account of the changing experience.

Then there are the additional scenarios. These will probably give the most interesting results. The suggested scenarios only vary one assumption at a time and their purpose is to identify sensitivity. The additional scenarios are supposed to further investigate these sensitivities.

Also, there will probably be interactions between the assumptions. The actuary has to really understand the interrelationships between assumptions. For instance, if interest rates go up, will lapses or default rates be affected as well. Deciding what interrelationships to test is left to the actuary's judgment. But you leave yourself open to doing a lot of scenarios, generating a lot of results, and maybe having too much information to digest.

## PANEL DISCUSSION

The timing of the work is flexible. The only thing the standard says is that it has to be done annually. We are anticipating that companies will integrate it with their annual planning cycle. It is not required during the rush of year-end.

The form that the report to the board will take is up to the actuary. We do not anticipate that the members of the board will want to look through stacks of computer output showing the results of every scenario the actuary has tested. We want the actuary to produce an interpretive report to the board summarizing good and bad results, and identifying possible risks and the company's sensitivity to them.

**MR. PAUL A. HEKMAN:** The relationship between what I am going to say and actually doing the work is probably best described by the late Adlai Stevenson from the State of Illinois, who described it as "the relationship between a fan and a fan dancer. The object is not so much to cover the subject as merely to call attention to it."

My discussion will center on the topic of guidelines for selecting assets for ALM projection. Why would we do this? Why select assets? What is the context in which this work takes place? I think the principal driving force is the nature of the new actuarial opinion, which is in the process of being set up by the organization near and dear to all of us in the U.S., at least, the NAIC.

We have some significant changes in the wording of the opinion here. It says, "the reserves and related items when considered" -- and here's some new wording -- "in light of the assets held by the company." We can no longer presume that we have generic assets in the portfolio that cover the reserve assumptions that we make. We have to demonstrate that we have the necessary specific assets in the portfolio.

Then, at the tail end of the opinion we have to "make adequate provision for the anticipated cash flows." This is no longer a generically worded sense of obligation; it is a more specifically worded requirement to investigate and provide for cash flows.

The normal situation in which we go about selecting assets occurs in the process of doing reserve testing for an isolated block of business. For example, you may have \$50 million worth of single-premium deferred annuity business, while your entire asset portfolio may be in excess of \$100 million.

Usually, there will be other blocks present to require most of the remaining assets, but it is generally considered primarily obligatory at this point to test reserves on just the interest-sensitive products. That could be disputed, but that seems to be the focus of what we are talking about most lately. So, when you confine your attention to a single line of business, obviously you do not need all of the assets.

Even if you are testing the entire company, it is kind of nice when the total company reserves are less than the total invested assets, so you do not have to use all of them. That does not always happen. There may be situations in which there are assets you do not want to use, for a variety of reasons. We will talk about some of these a little bit later.

## CASH-FLOW TESTING

This is a caveat that is important to recognize when we do the selection process. It is necessary to keep the balance of the company in mind. We do have to demonstrate that the remaining assets do cover the remaining liabilities. Sometimes this is an easy demonstration and sometimes it is not.

One of the other reasons for selecting assets from the portfolio has to do with what I call the sufficiency/deficiency problem. If you have a company that is been around for a few years, you may have a situation in which you have perhaps an old block of ordinary life business that just throws out profits year by year. The required reserves are overly conservative and the premiums were conservatively priced, and so there's really no question in your mind that you have assets in your portfolio adequate to cover that block of liability.

On the other hand, you may have another block of business that requires very high-yield rates. And you do not have enough assets in your portfolio to provide those high-yield rates to all lines of business.

One of the options that you have in doing this work is just to prorate the entire asset portfolio. If your deferred annuities are 20% of your total liability portfolio, you can just project all the assets and use 20% of the result to do your cash-flow testing. However, if you have this diverse situation that I have been describing here, where you have these different blocks of business with different yield requirements, what will typically happen when you do this is the annuities, for example, may turn out very badly because of this averaging of the overall yield rates, and the old life block looks just splendid.

You are then put in the situation of proving that the more than sufficient profits on the life block are adequate to cover the losses on the annuities. Not all regulators are happy with this kind of aggregation.

So it is possible instead to go into the asset portfolio and select the specific assets that you need to cover your annuities, but then you must not overlook the concept that I mentioned a bit ago, that it is necessary to demonstrate that the remaining assets still provide for the remaining liabilities.

However, before zeroing in on the selection method, I do want to take a quick look at that option of doing the pro rata approach, because it has worked its way into actuarial practice through the work that has been done for the New York Regulation 126.

Prorating the assets is specifically permitted by New York Regulation 126. It goes on to state however, that "the adequacy of the assets for the other blocks may be neither prejudiced nor endangered." We can do some actuarial hair-splitting as to what the difference is between "prejudice nor endangered," but let's save that for later.

Another requirement is that the proportion of assets that you select from the portfolio has to be based on the statement value. So you may make the determination, for example, that 20.776% of your assets, based on statement value, equals the reserves being tested, and that is the pro rata portion that you go ahead and use.

## PANEL DISCUSSION

Another requirement here is kind of an interesting one. It seems to be one of those that should not have to be there, but it is. The regulation stipulates that when you do prorate, you have to do it consistently throughout the projection. What this means is that it is considered "dirty pool" to use a pro rata approach for three scenarios and to select assets for the other four . . . .

Now we will skip back to the selection process. We will assume that you have examined the issues and decided that you are going to go ahead and select assets.

First of all, what are the objectives of the selection process if you decide to select assets? Your primary objective in the process is to meet the yield, the duration and convexity requirements of the lines being tested. So you are going to have to go into that asset portfolio and make sure that you select a group of assets that meet this rather complex set of requirements.

A secondary, but probably no less important requirement is that you, once again, take into consideration the rest of the liabilities. That is, the remaining assets do have to meet the yield, duration, and convexity requirements of the balance of the liabilities as well. Now I do not want to delude you into believing that this is not a lot of work. It is a lot of work, particularly, if you are dealing with large portfolios.

I would like to make a very, very strong suggestion that, before undertaking the job, you get together and build a consensus with your investment reporting people and with your investment advisors to create an environment in which the work that you do can be used to create a practical segmentation for company use. That is, if you are going to do all this work, it is worthwhile having somebody around who is committed to maintain it for you, so that a year later, you do not have to go through the work again.

In the process of having this discussion with your investment people, you may actually discover that the work has already been done. I worked for one company for a year before I discovered that they actually did have segmented portfolios and I never knew about it, until I asked the right people. This is part of the nature of working in conglomerates these days. But it is worth asking the question. Does a segmented portfolio already exist somewhere in the organization and is somebody keeping track of these assets? In which case, I would be inclined to use it. I think the people that are doing this segmentation would be very, very interested in seeing the results of it. But if the segmentation isn't there, try to get a commitment from people who have the ability to maintain it after you create it.

It is nice if something can be left over for surplus when you get done with the segmentation process. We will talk about that a little bit more later on. I want to go very quickly through special requirements of various lines of business. Most of these are familiar to you, but I want to keep this on a fairly fundamental level here.

Deferred annuities are the ones we often look at. Of course, these are the ones that have some nasty disintermediation problems. Universal life can also exhibit disintermediation, either through the withdrawal process or through the policy loan process; in both of these cases you are concerned about liquidity.



## CASH-FLOW TESTING

Traditional products can be sensitive to interest movements as well. I think it has been demonstrated in the 1980s that policy loan utilization rates increase when interest rates go up.

Single-premium immediate annuities may require your attention. Here, I really am talking about any situation in which you have guaranteed payouts for many years. They may fall under the category of settlement options, structured settlements, lottery payouts or whatever. A number of companies have been active in these markets for a number of years, since the early 1980s. I remember pricing these for one of my employers back in 1982 and 1983, and at that time, you could buy assets yielding 13-14%. If whoever did the pricing of these at that time was using an interest rate of 13% forever, I would guess that probably you do not have any of those 13% assets in your portfolio anymore. If the reserve was based on something approximating that interest rate, this may mean that the reserves on this block are seriously inadequate. So pay some attention to these cash flows. They are not really interest sensitive but the world has changed for the underlying assets on these blocks of business. It is important to pay attention to some of these other issues, in addition to just the disintermediation problem.

You have the reinvestment risk, of course, on GICs as well.

Variable products are often considered to be sort of immune to this process, because supposedly the company isn't carrying the investment risk on these contracts. However, many variable products have fixed buckets where the policyholder has the right to move money into the general account of the company.

One of the major actuarial battles I lost in the last few years had to do with one of these situations. The company was producing a large quantity of variable annuity product. It had a fixed bucket and because of the surplus strain, there was some interest on the part of the directors of the company to use a Commissioners Annuity Reserve Valuation Method (CARVM) reserve calculation on the variable annuity product. I was not necessarily opposed in principle to that, because after all, if the policy did surrender, we would collect the surrender charge from either the general account or the separate account.

The problem that I was concerned with was the general account by itself. If the policy were surrendered out of the general account, sure, we could collect the surrender charge on that, but for a numerical example, the policyholder might have \$1,000 of fund value in the general account. If he surrenders, he gets \$950. But if he wants to move the money to the separate account, he can move all \$1,000 over there. That is cash flow, and I was concerned about that situation. The accountants were happy to report to me that the policy provided that the money could not all be moved at once. There was a provision in the policy that required, if money were to be moved from the fixed account bucket to the variable bucket, it could only be done over a period of four years.

I finally threw in the towel when one of my own FSAs went along with the accountants and said, "Okay we will go ahead and do it." About six months later, the parent ran into some financing difficulties. The parent's name was the same as the insurance company's name. The policyholders didn't know the difference and

## PANEL DISCUSSION

became very nervous about their account values. It was not in the company's or the policyholder's interest to have these people pull their money out of the company completely, so we encouraged people to move their money from the fixed account bucket to the variable bucket, and of course, you can probably guess what happened. We waived that four-year requirement. I have forgotten the dollar amount, but you would be amazed at how quickly money can move from the general account to a variable account. We had a lot of people working overtime just moving money out of that account. So you need to pay attention to variable products as well.

Even disability income, you know, is not what you call an interest-sensitive product, but it certainly is sensitive to recessionary environments. We are maybe talking about sensitivity analysis perhaps more than an economic analysis here.

Now at this point, we have talked about the objectives of the process and some of the particular hazards that you are interested in protecting against. So you come to your office early on a Monday and you are ready to begin work. And after you get through your obligatory management meetings, and attending to the coffeepot, and so on, you reach into your desk drawer and you pull out . . . Schedule D.

Now it is readily apparent from reading this, to me anyway, that this is not much use to you in its present form. So I would like to make two suggestions at this point, if you are ready to proceed with the process of selecting some assets from your portfolio.

First of all, your Schedule D is in alphabetical order. Alphabetical order is not very useful to actuaries. What you want, of course, is a database of some sort. You want to be able to go into this schedule and re-sort based on yields and durations and maturities and compute average yields and durations and maturities and select out and move things around. A standard spreadsheet program works nicely for this.

You may have more elaborate software, but I would suggest that before you get very far into the process, you have somebody go to work on converting your Schedule D to some sort of database on which you can do some computations.

A lot of companies have Schedule D in electronic format; it is maybe in text files, but a lot of those can be easily converted to spreadsheet formats. So I would strongly suggest doing that for a starter.

While that project is being worked on, I would suggest going ahead and concentrating on the liabilities first. Remember that we are trying to find assets that support the liabilities. You are pretty well stuck with your liabilities. The assets can be moved around and sold and repurchased. So do the liability projection first. I would also suggest that if you do not have a good liability projection system, probably that is one of the most essential things that you need nowadays for any company that is in the process of doing insurance work. I just do not know how you can do without it. It is so useful for budgeting, planning, strategy and many other things as well.

So concentrate on the liabilities first, to see what kind of assets the line of business needs. Let's recap some of these things that we need. We are going to have to determine what sort of yield requirement we have. We are going to have to

## CASH-FLOW TESTING

determine what sort of duration the block of liability needs. We are going to have some concerns about convexity and we are going to have some concerns about liquidity as well.

Let's talk about yield briefly. How do you measure the required yield for a block of business? Perhaps we ought to define briefly what it is first. I would define it as the investment income needed in order to achieve statutory break-even over the remaining life of the block of business.

A couple of conditions attached to this are: the starting assets that generate this investment income must equal the starting reserves. And I would, for this initial run, keep any profits within the projection. An exception to this might be a block of business in which you have obligatory dividends, such as participating business, in which case, you may want to run it with and without the dividends.

Now, there are some alternatives for computing required yield. One method might be, if you have information on how the products were priced, to go back and get some pricing data to determine what sort of expected yield would be needed. However, if your company happens to be composed of, say, the dismembered remains of 12 extinct other insurance companies, a lot of this information simply is not going to be there. And even if it is, it may be obsolete anyway. So I would suggest that that probably is not one of the better sources, and it is probably a laborious method besides.

I can give you a very quick and dirty method that sometimes works. Go ahead and project the liabilities, but without the investment income. In most blocks of business this will create a situation in which the profits are going to be somewhat negative. So reverse the sign on the negative profits, divide by the average reserve, and voila, you may have an estimate of what required yield you need on the supporting assets. This is just a first shot, mind you, but at least it gives you something to work towards as you put your selected portfolio together.

One of the disadvantages of this approach is that it produces yields that will be different every year. And depending on how the reserves move around, which many do nowadays, because of the disappearing surrender charges, it may produce a lot of movement. You may have yield requirements of 2% in one year, -5% the next, and 20% the next. A little more elegant alternative perhaps, if you have the software to do it, is to do a gross premium valuation and solve for the interest rates to match your starting statutory reserve.

If the reserves are high enough, you may end up requiring very little yield at all. I have seen these situations. I worked on one block of business once that was so conservatively reserved and priced, I believe the \$100 million block of business would very nearly have stayed afloat on \$35 million of policy loans. It took very little additional assets to keep it alive. So this may happen. It is a nice situation to be in, because it frees up a lot of your best assets to use for other lines of business.

You need some duration targets. Here again, if you have a projection system -- and you can't do this work without it -- you will get some cash-flow output. Obviously,

## PANEL DISCUSSION

you need to do it under multiple scenarios because you will get different durations in different environments.

What will typically happen, of course, if you get different durations, is that this provides convexity data and so by the time you have done this with several scenarios on the liabilities only, you will have a pretty good handle on what kind of yield rates you are looking for, what kind of duration/maturity schedule you are looking for and also you will have some information on convexity data when you see how that duration moves around under the various scenarios that you are working with.

I mentioned liquidity a little while ago. I want to pose a question to you on that. Suppose you have a block of deferred annuities that are backed exclusively by private placements, with very high yield, short duration and high quality. Would you be willing to sign an opinion for that block of business, stating that the reserves do in fact provide for this?

I am not going to give you a definitive answer to that because I think that there are many things that need to be considered. For one thing, you need to consider the liquidity of the rest of the company and what other assets and liabilities there are. So this is not an open-and-shut situation. But it is one of the issues that may come up. If this is the only way that you can cover this particular block of business, I would be a little concerned about it.

Finally, in the process of working through a portfolio, you would be amazed what you find in there sometimes. There's that common stock in the Russian real estate partnership. It should not surprise you to find a few things in default. You may own a shopping center instead of a commercial mortgage -- this sometimes happens.

What about the nonadmitted assets? Sometimes assets are nonadmitted for what I guess I would call structural reasons rather than real ones. I have seen situations in which some of the nonadmitted assets are of better quality than some of the admitted ones are.

What do you do with situations such as these? Obviously, you cannot use nonadmitted assets to cover your reserves, but I think they can provide a certain comfort level overall.

A lot of people feel the same way about Collateralized Mortgage Obligations (CMOs). We see a frequent desire just to set these aside, but sometimes you just cannot leave these out. CMOs are particularly chosen by many investment advisors to cover specialized cash-flow situations with particular kinds of liabilities. And it is devilishly difficult to project the cash flows for them. And so you can't move them aside.

This is another interesting one. I worked in one company once in which we had a number of construction loans for which the amortization pattern was negative. They also had certain balloon points, and when the balloons were due, the company had an obligation to provide further funding in the project. So you can have assets with negative cash flow. This creates a very interesting situation.

## CASH-FLOW TESTING

What do you do with some of these dogs or dregs? Ideally, you can move them over to undemanding lines. I include surplus in this category, only in the sense that you are not required to opine, at least in the U.S., on the quality or quantity of the surplus. By the time you get done with one of these projects, you have a pretty good handle on both the quantity and quality of your surplus. But this is one of the ways of dealing with some of these, particularly, some of the very troublesome ones. If you have lots of surplus, you can move some of them over there.

If the asset is publicly traded and it is kind of a dog, but it has a market value, you can make the assumption that it gets sold and just bring the money in as cash in the projection process.

Some of these, like the CMOs may behave fairly predictably in certain types of scenarios. So it would be possible to model it as something a little more generic, a little more common, like some type of bond, just for that scenario.

If all else fails, it may be necessary to do that fine actuarial thing -- homework -- and actually haul out a prospectus and spend weeks reading the thing; if you have seen some CMO prospects, you know what I mean by this. They sometimes approach three-quarters of an inch thick. But sometimes there is no alternative to doing that, particularly if they comprise a significant portion of the portfolio. There are other sources of some of this information.

It is permissible in doing this work to rely on other sources. Your asset advisor may have some information. There also are some software programs available to help you project some of these difficult cash flows.

I would like to conclude then by saying that you do have two options. You can prorate or you can select; either way, do not overlook the balance of the business. Go ahead and try to use the work in setting up a segmented asset portfolio, if you do not already have one. And do not forget to pay attention to the details. If you have difficult assets, sometimes the only option is to sit down and do the right actuarial thing as best you can with the software and the manpower that you have available.

**MR. SCOTT H. FRANK:** Is there much similarity between Valuation Technique Paper No. 9 in Canada and New York Regulation 126? My company is currently doing Regulation 126 and is preparing to do Technique Paper No. 9.

**MR. ENGELS:** I would not really think that there is very much difference. If you could do Regulation 126, you probably have the capability of doing Technique Paper No. 9. It is just that you are doing it on a Canadian basis with the Canadian definition of assets, etc.

**MR. ROBERT F. DAVIS:** I am rather appalled at the amount of work all this cash-flow testing and asset valuation is going to generate. The one thing I am wondering about is if a company really has good, high-quality assets that it can borrow against, why do we have to worry about cash-flow testing? The only concern you might have is if it will have to pay interest on any amounts it had to borrow. It is my opinion that it is relatively easier to project liability cash flows, but I think a lot of actuaries have very little experience with assets. I think this is going to generate an

## PANEL DISCUSSION

awful lot of work from consulting firms. I am just a little bit suspicious that they may have been behind a lot of these requirements.

MR. HEKMAN: Well, I am a consultant, but I think the situation you described is correct; that is, you may have assets that you can borrow against. The problem that happens with many of these interest-sensitive portfolios is the borrowing that you may have to do is most likely going to happen in a situation in which the economy has developed a kind of overheated condition with high interest rates, reducing the value of assets that you purchased a number of years ago. Perhaps the best example of this is if you put a big block of deferred annuities on the books right now when we are kind of at the bottom of an economic cycle. Then five years from now we may have an economy that is running with a full head of steam. Interest rates perhaps may be up 200, 300 basis points higher than they are now. If you still have those assets, then you cannot afford to pay the policyholders any more money on the credited rate. And so they may run. You can borrow money to cover those outflows, but the rate at which you borrow may exceed the rate at which you originally invested and totally kills your profitability. So you very quickly end up in a negative surplus situation if that happens. So what we are trying to do is anticipate that sort of event here and try to tailor assets to liabilities so that there is enough liquidity and enough rollover in the asset portfolio so we always have plenty of cash. We do not have to get into that very difficult borrowing situation.

FROM THE FLOOR: One of the questions that I wonder about is when I look at portfolios of assets and liabilities, I typically see a much longer duration on the asset side than on the liability side. So as we go through picking and choosing which assets to segregate into our asset portfolios, we end up with a situation where we are still probably long all over. Comments?

MR. HEKMAN: What usually results, if this is consistently the case, is that you will end up with a lot of scenarios in which the company just does not perform very well. And if that happens, I think it is incumbent on the actuary to put in his opinion, the fact that probably the reserves are not adequate to cover some very reasonable scenarios. So you are possibly looking at a reserve increase in this kind of situation.